CHAPTER 3 - AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter provides a summary of the existing environment within the Planning Area. Generally, the discussion is limited to the resource concerns that could be affected by fluid minerals leasing and subsequent activities. These resource concerns have been identified as part of the issues listed in Chapter 1, and/or need to be described for an overall understanding of the affected environment and identified issues.

Much of the information in this chapter is summarized from material contained in the Management Situation Analysis (MSA). In preparing the MSA, environmental resource data were collected and compiled using existing data from several sources. The majority of the data were provided by the Las Cruces Field Office of the Bureau of Land Management (BLM) from Federal, State, county, and local agencies including but not limited to the U.S. Geological Survey, U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish (NMDGF), other State agencies, counties, and other public and private sources. Data included published and unpublished reports, maps, and digital format (geographic information system [GIS]). The data compiled represent a level of detail appropriate for and commensurate with the programmatic nature of this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS). Where data were lacking, the data were interpreted from the best available sources. Field verification of the data was not conducted. Sources used in the preparation of this RMPA/EIS are listed in the References section.

GIS has been used extensively to capture, manage, analyze, and display the geographic data for this RMPA/EIS. In particular, GIS was used effectively to execute certain complex spatial analyses. It is important to note that there are differences between the areal data estimated for the 1986 Resource Management Plan (RMP) and the more recent GIS data. For the purposes of this RMPA/EIS, the more up-to-date GIS data have been used.

Maps summarizing environmental resource information relevant to the RMPA/EIS planning and analysis are provided in the map section of this document. More comprehensive resource maps were prepared in conjunction with the MSA (refer to Chapter 1 and List of Maps). The MSA and accompanying maps are available for review at the Las Cruces Field Office of BLM.

In accordance with the National Environmental Policy Act regulations codified in 40 CFR 1502.15, the affected environment section discusses the existing condition of the human and natural environment that potentially could be affected, beneficially and adversely, by the alternatives. The affected environment is characterized for the following resource concerns:

- Physiography and Topography
- Climate and Meteorology
- Lands and Access
- Geology and Minerals
- Soils
- Water Resources
- Surface Water
- Groundwater
- Air Quality
- Noise
- Vegetation
- Wildlife
- Special Status Species
- Livestock Grazing
- Cultural Resources
- Paleontological Resources
- Recreation
- Visual Resources
- Special Management Areas
- Social and Economic Conditions

3.2 PHYSIOGRAPHY AND TOPOGRAPHY

The Planning Area is located in south-central New Mexico, encompassing Sierra and Otero Counties. The area lies within the Basin and Range physiographic province with the exception of the northeastern-most corner of Otero County, which is in the Great Plains province. Typical features of the Basin and Range physiographic province include rugged and steep fault-block mountain ranges, broad basins, and more gentle volcanic landforms. From the northwest to the southeast boundaries of the Planning Area, important features include the Cuchillo Mountains (covered by the Mogollon-Datil volcanic field), Palomas and Engle Basins, Rio Grande Valley, Caballo and Turtleback Mountains, Jornada del Muerto Basin, San Andres Mountains, Tularosa Basin, Sacramento Mountains, Otero Mesa, and Brokeoff and Guadalupe Mountains. Other prominent topographic features of the Planning Area include Crow Flats, Hueco Basin, Jarilla Mountains, Godfrey Hills, Chupadera Mesa, and the foothills of the Black Range and Mimbres Mountains.

The average elevation in the Planning Area is approximately 4,500 to 5,000 feet, ranging from approximately 3,650 feet in southeastern Otero County (valley areas of Crow Flats) to approximately 11,808 feet in the Sacramento Mountains (Sierra Blanca Peak) (BLM 1981a, 1985b).

3.3 CLIMATE AND METEOROLOGY

Southern New Mexico has an arid to semi-arid continental climate with mild winters and hot summers. The climate is determined primarily by a subtropical high pressure system. As the summer Bermuda High intensifies and moves westward, the predominant wind flow is from the southeast. This wind pattern brings in moist air from the Gulf of Mexico and provides a summer maximum precipitation pattern through localized thunderstorms. July, August, and September are the wettest months of the

year. As winter approaches and the Bermuda High weakens, polar masses intrude into the area and the general wind pattern is from the northwest and west. Average precipitation below 6,000 feet is between 8 and 10 inches annually and between 14 and 16 inches at higher elevations.

The average annual temperature in the Planning Area is approximately 60 degrees Fahrenheit (EF) (15.6 degrees Celsius [EC]). The average maximum temperature in July is approximately 96EF (35.6°C) with maximum readings generally over 100EF (37.8°C). The average minimum temperature in January is approximately 39EF (3.9EC) with minimum readings generally in the low 20s (-6.7 to -4EC).

Wind speeds average approximately 6 to 10 miles per hour on an annual basis in the Planning Area and generally are highest in the spring (March to May). These spring winds are generally from the west and may exceed 30 miles per hour. Locally strong winds associated with summer thunderstorms may come from any direction and frequently exceed 30 miles per hour, but are usually brief in nature.

3.4 LANDS AND ACCESS

This section summarizes the lands and access components within the Planning Area including jurisdiction/surface ownership, existing land uses, utilities and rights-of-way, and access and transportation.

3.4.1 Jurisdiction/Surface Ownership

Jurisdictions shown on Map 3-1 depict the lands administered by Federal, State, and local agencies, and lands privately owned. The Planning Area contains about 7 million acres, of which the BLM manages more than 1.8 million (exclusive of the 606,198 acres of McGregor Range managed cooperatively with the military). In addition to the surface ownership, BLM also administers approximately 5 million acres of Federal mineral estate. Other jurisdictions within the two counties include the following:

- Federal
  - Department of Agriculture
    - Gila National Forest
    - Cibola National Forest
    - Lincoln National Forest

Department of Defense
- White Sands Missile Range
- Holloman Air Force Base
- Fort Bliss Military Reservation

Department of the Interior
- BLM
- White Sands National Monument
- Bureau of Reclamation

Mescalero Apache Indian Reservation

State
New Mexico State Trust Land

Private Land

The land ownership in the Planning Area resembles a checkerboard pattern. Acres associated with jurisdictions in the Planning Area are shown in Table 3-1. Private (or patented) land and State Trust Land include split estate; that is, privately owned or State-administered surface land overlying Federal fluid mineral estate.

Although inholdings, lease agreements, joint ownership, cooperative agreements, and other land ownership situations may be present in the Planning Area, they are not depicted on Map 3-1.

3.4.2 Existing Land Uses

The Planning Area comprises two counties characterized by their rural qualities, vast open spaces, and generally sparse population (Map 3-2). Otero County maintains a comprehensive plan for management direction, the Otero County Comprehensive Plan (May 1998). Sierra County does not have a general plan; the County uses the South Central New Mexico Overall Economic Development Program as management framework (July 1998).

Residential, commercial, and public uses in Otero County are concentrated in the communities of Alamogordo, Tularosa, Orogrande, and around Holloman Air Force Base. In Sierra County, these uses are located primarily within the communities of Truth or Consequences, Williamsburg, Hillsboro, Cuchillo, and Kingston. Rural residential and commercial properties are sparsely located throughout the Planning Area.

TABLE 3-1
LAND STATUS IN ACRES[a]

Landowners/Managers	Sierra County	Otero County	Total
Federal			
Department of Agriculture			
Forest Service	375,158	558,948	934,106
Department of Defense			
Military Withdrawn	523,423	713,304	1,236,727
Military Acquired	0	69,449	69,449
McGregor Range[b]	0	606,198	606,198
Department of the Interior			
Bureau of Land Management	781,825	924,828	1,706,653
National Park Service	0	92,394	92,394
Bureau of Reclamation	36,851	0	36,851
Other			
Public Water Reserves	200	492	692
Total Federal	1,717,457	2,965,613	4,683,070
Tribal			
Mescalero Apache Indian Reservation	0	459,887	459,887
State of New Mexico			
State Trust Land	283,979	339,484	623,463
Split estate[c] (State Trust Land surface/Federal fluid minerals)	(5,667)	(9,404)	(15,071)
Private			
Private Land	709,323	473,815	1,183,138
Split estate[c] (Private surface/Federal fluid minerals)	(217,503)	(133,943)	(351,446)
Total acreage (split estate not counted)	2,710,758	4,238,799	6,949,557

SOURCE: Bureau of Land Management, Las Cruces Field Office and New Mexico State Office, 1998
NOTES:

[a] Inland water areas included in ownership

[b] McGregor Range is cooperatively managed by the BLM and U.S. Army

[c] Surface acreage only is included in total

Agricultural uses are associated primarily with livestock production, including cattle, hogs, sheep, and chickens. There is limited crop production of hay, barley, and wheat. Pecan orchards are grown in the Alamogordo area.

The primary use of public land is livestock grazing. Mining, mineral material excavation, rights-of-way, leasing, and dispersed recreation constitute the other uses occurring on public lands. The BLM currently administers mineral materials leases on approximately 114 acres within BLM's Decision Area. Current uses of particular concern include Community Pit 7, a public source of sand and gravel, and the Caballo Mountain Communication Site. Military and space exploration research activities occur on some Federal land within the Planning Area, including McGregor Range, Holloman Air Force Base, and White Sands Missile Range. Some of the land associated with military activities has been

withdrawn from public use or its use is regulated to protect public safety, such as the former Air Force bombing and gunnery range in southern Otero County.

In accordance with the Recreation and Public Purposes (R&PP) Act, BLM has the authority to lease or patent public land to governmental or nonprofit entities for public parks, building sites, or other public purposes. Currently, there are a total of 32 R&PP patents or leases—12 in Sierra County and 20 in Otero County. At present, the total number of acres involved in the 32 sites is about 1,799 with 218 acres in Sierra County and 1,581 in Otero County. Land uses occurring on land leased or patented under the R&PP within the Planning Area include landfills, recreation (parks, shooting ranges), and other public purposes (e.g., a fire station and sewage treatment plant). Lessees or owners are generally a city or county, but may include State agencies, school districts, or nonprofit associations.

Public water reserves are another protected use on public land. The reserves, about 40 acres each, are withdrawn land for the purpose of protecting water resources. Public water reserves are defined as the legal subdivision or area within 0.25 mile (400 meters) of a spring or water hole.
There are no commercial timber resources located on public land. Noncommercial timber resources include piñon-juniper forests at higher elevations and broadleaf species such as cottonwoods and Gambel oaks along Tularosa River and Three Rivers Creek.

3.4.3 Future Land Use

According to information from county and BLM management plans, general trends of future land use within the Planning Area include residential, commercial, and industrial growth that is anticipated to develop in areas surrounding the current population centers.

The primary objective of the Otero County Comprehensive Plan is to protect and enhance the scenic beauty and diversity of the land while accommodating growth. The primary objective of the Sierra County Council of Governments' overall economic development program is to promote sufficient economic opportunity within the County for residents to find suitable and adequately compensated employment. This is to be accomplished with an increase in outside economic investment and an increase in the values of goods and services produced within the County.

Future land uses anticipated on public land generally include granting additional rights-of-way, grazing and minerals leases, and recreation.

3.4.4 Utilities and Rights-of-way

This category includes electric transmission and distribution lines, pipelines, fiber optic corridors, transportation corridors, and the corresponding rights-of-way. Within the Planning Area, there are numerous electrical transmission and distribution lines, as well as telephone lines and various natural gas, water, sewer pipelines, and two long-distance petroleum product pipelines. Petroleum product lines include the Navajo Pipeline and Diamond Shamrock Pipeline, both in Otero County (the lines parallel each other and both cross Otero Mesa) (Map 3-2). Currently, there are approximately 3,810 acres of rights-of-way granted by BLM.

3.4.5 Access and Transportation

The main component of the transportation system within the Planning Area is the roadway network. Two rail lines are present, one each in Sierra and Otero Counties. Map 3-2 depicts access and transportation in the Planning Area.

Transportation System

Access in the Planning Area is based entirely on the use of County and State roads and U.S. highways. Primary transportation routes in the Planning Area include County Roads 59, 52, 27, 26, 142, and 24; State Routes 82, 70, and 506; and Interstate 25 (I-25). The only access road in the Planning Area for which BLM is responsible for maintenance and control is the road to the Caballo Mountain radio communications site in Sierra County.

Several roads in the Planning Area are closed periodically to ensure public safety during military exercises. Closures affect US 54 and 70, and State Route 506 within the Planning Area; these roads are major arterials in Otero County.

There are several thousand acres of public land that do not have direct access. These generally are located where large amounts of private and State Trust Land are interspersed with public land in a checkerboard pattern. Some areas of concern include the Cuchillo Mountains, Animas Hills, and Piñon area.

Lake Valley Backcountry Byway is the only National Backcountry Byway in BLM's Decision Area. This route includes State Highways 152 and 27. The Byway begins at the junction of I-25 and State Highway 152 and proceeds west to the historic town of Hillsboro. The Byway route then turns south onto State Highway 27 towards the historic mining town of Lake Valley and ends at Nutt where State

Highway 27 intersects State Highway 26. The route features scenic views of the Black Range Mountains, Caballo Mountains, Cooke's Peak, and Las Uvas Mountains.

The total mileage of major roadways in the Planning Area (listed in Table 3-2) is approximately 716 miles. Many light-duty and four-wheel drive roads also traverse the area.

Traffic Volumes and Roadway Capacities

The New Mexico State Highway Department reports average daily traffic (ADT) counts by roadway within individual counties. The ADT counts are reported in milepost increments with similar ADTs within each county. ADT counts may vary by as much as 5,000 vehicles on the same stretch of roadway depending upon the surrounding land use (i.e., rural versus urban areas). This factor makes documenting ADT counts by roadway and county difficult. Table 3-2 shows ADT volumes for roads in Sierra and Otero Counties and New Mexico State highways. Only those roads that are at least 10 miles long with an ADT count greater than that of State Highway 506, or an ADT volume of 30, are shown.

TABLE 3-2
AVERAGE DAILY TRAFFIC VOLUMES
(STATE, AND INTERSTATE ROADS LONGER THAN 10 MILES WITH AN ADT VOLUME OF 30 OR GREATER)

Road	Length (miles)	ADT 1997	Road	Length (miles)	ADT 1997
NM 24	26.5	589.0	US 70	259.3	1754.0
NM 130	21.9	650.0	US 82	43.7	2215.0
NM 244	29.4	287.0	I-25	104.1	2649.5
NM 506	31.9	30.0	NM 59	23.1	217.0
NM 26	37.2	40.0	NM 142	10.1	138.0
NM 27	30.2	73.0	NM 152	66.1	311.4
NM 52	38.8	290.0	NM 187	36.2	1266.0
NM 181	11.8	782.4	NM 51	17.9	2075.0
NM 1	10.9	40.1	NM 6563	15.5	657.0
US 54	101.6	5960.0	—	—	—

SOURCE: New Mexico State Highway and Transportation Department 1999

Traffic Accidents

Total accident counts by year and county are available from the New Mexico Traffic Safety Department (NMTSD). NMTSD had Otero County data for the years 1995, 1996, and 1997, and Sierra County data available for 1996 and 1997. Data from both counties are reported in Table 3-3.

TABLE 3-3
ACCIDENT TOTALS BY YEAR

Year	Sierra County Number of Accidents	Otero County Number of Accidents
1997	158	524
1996	171	497
1995	Not Available	410

SOURCE: New Mexico Traffic Safety Department 1999

Accidents in Otero County have been increasing over the past three years of available data to a high of 524 in 1997. Sierra County saw a slight drop in accidents from 1996 to 1997. Accident counts by segment for Federal and State highways in both counties were available for the period 1995 to 1997 and is reported in Table 3-4. Accident counts for individual County roads were not available.

All of the Federal and State roadways within the two counties showed an increase in traffic accidents from the year 1995 to 1997. The exception was US 82 in Otero County, which experienced a decrease in traffic accidents, and US 54 in Otero County, which had the same number of accidents in both 1996 and 1997.

TABLE 3-4
FEDERAL AND STATE HIGHWAY ACCIDENT TOTALS
BY ROADWAY SEGMENT AND YEAR

	1995	1996	1997
Sierra County			
Federal Highways			
I-25 (Milepost 52.03 to 104.2)	65	79	83
Otero County			
State Roads			
US 82 (Milepost 0.0 to 43.75)	173	206	202
US 54 (Milepost 0.0 to 107.6)	812	165	165
US 70 (Milepost 177.8 to 259.5)	82	94	109

SOURCE: New Mexico Traffic Safety Department 1999

3.5 GEOLOGY AND MINERALS

3.5.1 Tectonics and Structural Regime

The Basin and Range physiographic province of New Mexico is highly influenced by the Rio Grande Rift with the exception of the westernmost quarter of Sierra County, which is covered by the Mogollon-Datil volcanic field. The Rio Grande Rift is a series of north-south trending basins, which in southern New Mexico widens into a series of parallel basins separated by intrarift horsts. From west to east

these Tertiary age tectonic features are Palomas and Engle Basins, Caballo Uplift, Jornada del Muerto Basin, San Andres Mountains, Tularosa Basin, Otero Platform and Sacramento Uplift, Salt Basin, and Guadalupe Uplift. Map 3-3 provides the locations of the physiography/tectonic features.

3.5.2 Stratigraphy

Only minor stratigraphic differences are present in Otero and Sierra Counties indicating that the areas have similar geologic histories. Variation in thickness, lithologic character, and/or presence of a formation within the local stratigraphic columns are related to depositional environments during tectonically active periods of geologic time. Tectonically active geologic time periods for the Planning Area include mountain building in the Pennsylvanian, Tertiary basin and range faulting, and late Tertiary rifting.

The pre-Pennsylvanian deposition generally was similar throughout the Planning Area. Cambrian through Mississippian time is represented by clastic and carbonate rocks of shallow marine origin. The Pennsylvanian rocks indicate a period of increased tectonic activity with areas like the Pedernal Uplift providing sediments for the basins. The basins collect thick sequences of clastic continental-dominated sediments near the uplifts with marine and near-marine clastic and carbonate facies within the basins.

Mesozoic rocks appear to be thin to nonexistent in most of the Planning Area. An exception is a potentially thick section of Cretaceous formations on both sides of the Caballo Uplift in the Palomas-Engle and Jornada del Muerto Basins (Foster 1978). Tertiary basin-fill sediments are found in great thicknesses in the basins and Tertiary intrusions also are present. The basin sediments are typically continental in origin.

3.5.3 Leasable Minerals

In keeping with the RMPA focus on fluid minerals leasing and development, the following description includes the potential ranking of fluid minerals and a brief discussion of the reasoning behind the ranking. A more detailed description of the fluid mineral potential is provided in Appendix A-IV.

Oil and Gas Resources

While oil and gas production currently does not exist in the Planning Area, the presence of source rock and reservoir strata is fairly well documented throughout the Planning Area. Occurrences of oil and gas

shows are noted in both the dominant Paleozoic section as well as the limited Cretaceous section. No area has been ranked as having "no potential" or "high potential" for oil and gas.

To distinguish the medium and low potential areas, the tectonic areas were evaluated for evidence of whether the trapping mechanism for the oil and gas resource likely would be present. In the Basin and Range province it was determined that while the source rock, thermal maturity, and reservoir rock likely would be present, the trap in the horst may be either nonexistent (breached) or likely to have been flushed by fresh waters. Therefore, the horst blocks or uplifted areas (Caballo Uplift, San Andres Mountains, Sacramento Uplift, and Guadalupe Uplift) with the exception of the Otero Platform have been given a low potential ranking. The Otero Platform is only partly uplifted and a large portion of its stratigraphic section is still beneath the subsurface. Map 3-3 presents the potential for oil and gas resources.

Thick, abundant, Pennsylvanian brown-to-black carbonaceous shales are potential source rocks, the dark basinal Devonian shales as secondary source rocks (Bulter 1988). Other favorable hydrocarbon source rocks are found in the Mississippian and Permian shales and carbonates (Bulter 1988; Grant and Foster 1989).

The evidence of thermal maturation for the source rocks indicates the presence of oil and gas shows throughout the Planning Area. A total of 98 wells have been drilled in Sierra and Otero Counties (35 and 63, respectively); at least 28 percent of these wells (27 wells) reported shows of oil and gas. Four of these wells potentially had significant gas production (refer to Appendix A-IV, Table A-3) and had they been near infrastructure, they may have been gas production wells. One of these wells is the recent Harvey Yates #1Y Bennett Ranch (Section 14, T. 26 S., R. 12 E., New Mexico Prime Meridian [NMPM]) which, depending upon success in the offsets, may warrant development of the infrastructure needed for production.

Reservoir rocks are almost ubiquitous in the Paleozoic stratigraphic section—of note are the Permian and Pennsylvanian bioherms and siliciclastic strata, Mississippian bioherms, and carbonates of the Silurian and Ordovician (Bulter 1988). Numerous opportunities appear to be available for trapping of hydrocarbons including wedge on wedge (unconformity pinchouts), stratigraphic pinchouts, biohermal, fault, and anticlines (Bulter 1988; Grant and Foster 1989). Pennsylvanian and Permian bioherms are likely to be more abundant near the temporal highs (Pedernal Uplift). Oil and gas accumulations in the Silurian and Ordovician may depend on structural trapping rather than stratigraphic facies changes (Bulter 1988).

Mesozoic rocks appear to be thin to nonexistent in most of the Planning Area and therefore potential is limited. An exception is a potentially thick section of Cretaceous sediment with oil and gas shows on both sides of the Caballo Uplift in the Palomas-Engle and Jornada del Muerto Basins (Foster 1978). Tertiary basin-fill sediments are found in great thicknesses in the basins and Tertiary intrusions also are

present. The basin sediments typically are continental in origin and are not oil and gas prone; shows seen in these sediments are believed to be due to older sources. The igneous intrusions near hydrocarbon accumulations are believed to destroy the hydrocarbons.

Geothermal Resources

Sierra and Otero Counties are located within the Rio Grande Rift, which is one of the three principal geothermal areas in New Mexico (Hatton 1978). While no known geothermal resource areas (KGRAs) have been identified in the Counties, anomalously warm springs (surface temperatures at least 50EF (10°C) above mean annual air temperature) and wells (thermal gradients exceeding 86EF (30°C)/per kilometer) have been recorded in the counties indicating geothermal potential (Callender and others 1983; Sammel 1979; Summers 1976; Trainer 1975; Witcher 1988). Both convection (hot-water-dominated) and conduction-dominated geothermal resources have been documented in Sierra and Otero Counties (Brookins et al. 1981; Muffler 1979; Sammel 1979; Witcher 1988).

Conduction-dominated geothermal systems are associated with the flanks of deep sedimentary basins and originate from deeply circulating groundwater along basin-bounding faults. These geothermal systems are believed to be very abundant in New Mexico, especially associated with the Basin and Range province; however, due to typical depth of the resource, the risk associated with exploration and development of the resource is believed to be high (Brookins et al. 1981; Sammel 1979; Witcher 1988).

Convection systems, less abundant in New Mexico, are associated with Quaternary igneous rocks and may be in part heated by magmatic activity (Brookins et al. 1981). While the exact origin of the heat source may not always be known, the anomalous temperature in spring or well discharges is a reliable criteria of the existence of convective systems (Witcher 1988). These convective geothermal resources typically are characterized as having structurally high and usually exposed faulted and fractured bedrock. The convective geothermal resource usually is found at shallower depths than conductive-dominated systems and its presence has been confirmed with a well or spring; therefore, the exploration and development risks are lower.

Geothermal resources identified in the Planning Area are low temperature (less than 194EF (90°C)) resources. While these resources are not suitable for electrical power generation, their uses include, but are not limited to, space and domestic water heating, crop drying, greenhouse heating, animal husbandry, fish hatching and farming, biodegradation and fermentation processes, de-icing, soil warming, low temperature refrigeration cycles, drying and curing of concrete, distillation and evaporation cycles, and hot water spas and baths. The drawback to the production of geothermal resources is that since the energy from these resources is transported as hot water, the user must be located near the production site (Sammel 1979; Starkey and Icerman 1983). Therefore, while an area

may have a high to moderate potential for geothermal resources, exploration and/or development may not occur if a potential end user is not near or identified. Map 3-4 presents the potential for geothermal resources.

Areas of the Planning Area that have had geothermal development or have been noted by authors as having potential for geothermal development were given the ranking of high potential. These areas include Truth or Consequences (Sierra County), Derry Warm Springs (Sierra County), and McGregor Range Camp (Otero County) (Hatton 1978; Muffler 1979; Starkey and Icerman 1983; Summers 1976). Recent geothermal exploration indicates that an area near Hillsboro also appears to have high potential (Witcher, personnel communications, 1998).

Coal Resources

Minor amounts of sub-bituminous coal have been extracted from the Engle coal field east of the Caballo Mountains. A larger and more promising coal deposit, the Sierra Blanca coal field, extends southward from Carrizozo in Lincoln County to the Three Rivers area of Otero County (Tabet and Frost 1978). Although coal production from this deposit has occurred in Lincoln County, none is known to have taken place in Otero County (BLM 1985b).

3.5.4 Locatable Minerals

The locatable mineral resources of the area are diverse and include gold, silver, copper, lead, zinc, iron, molybdenum, cement-quality limestone, gypsite, turquoise, beryllium and other rare earth minerals, tin, uranium, alunite, zeolites, fluorite, and manganese.

Production of locatable minerals from public land within the Planning Area is sporadic. The potential is moderate to high in many areas throughout the Planning Area, typically located in the uplifts or horst blocks. In recent years, a nepheline syenite mine was established at Wind Mountain in Otero County prior to the mountain becoming an Area of Critical Environmental Concern (ACEC). Currently, efforts are underway to re-open the open-pit copper mine at Copper Flats in Sierra County.

3.5.5 Saleable Minerals

Sand, gravel, and stone are the most common saleable mineral materials in the Planning Area and generally are found along mountain pediments, particularly the eastern edge of the Sacramento Escarpment, and in arroyos adjacent to mountain uplifts. Eolian sand is found within the Tularosa and

Jornada del Muerto Basins. Cinders, fill material, building stone, and clay occur in minor amounts throughout the Planning Area.

Sales of mineral materials are made, when possible, from designated community pits. Existing community pits are Community Pit No. 4 northeast of Tularosa (Section 6, T. 14 S., R. 10 E., NMPM) and Community Pit No. 7 about 25 miles south of Alamogordo (Sections 9 and 10, T. 20 S., R. 9 E., NMPM).

Access to Community Pit No. 4 (Coyote Canyon) is problematic, decreasing its viability as a source of sand and gravel. Community Pit No. 7 (Escondida) is an important source of blow sand; however, the eastern portion of the community pit area has been largely depleted. Weekend use of Community Pit No. 7 is not authorized due to heavy use of the area by motorcycle recreationists (Red Sands Off-road Vehicle (ORV) Area). Community Pit No. 7 is the staging area for an annual motorcycle race held in mid-February. Extraction operations are suspended for one week to accommodate the race.

In addition to the community pits, there are two established Common Use Areas (CUAs), both in Sierra County. The 5-acre Green Canyon CUA, also known as the Garfield CUA due to its proximity to the town, is a source of red building stone located in Section 29, T. 17 S., R. 4 W., NMPM. Sales are for personal use only, not to exceed 110 tons per family per year. No mechanized equipment is allowed. The Apache Canyon CUA is a source of arroyo sand and building stone. The area is less than 1 acre within the Apache Canyon arroyo in Section 20, T. 16 S., R. 4 W., NMPM. Material is extracted only from the arroyo bottom and gravel bars, without disturbing vegetation. No disturbance is allowed within 5 feet (1.5 meters) of the arroyo bank and vehicles are restricted to the road.

Materials can be obtained from various locations throughout the Planning Area. In 1988, one pit in Sierra County and 11 pits in Otero County were producing sand and gravel (Barker et al. 1988). An expanding population coupled with major road work has increased the demand for sand and gravel resources. Except for site-specific construction projects, it is not probable that these resources will be needed from public land.

3.6 SOILS

Soils within the Planning Area typically consist of loam; silty clay loams; and sandy, gravelly, gypsiferous, or cobbly loams. Rock outcrop is common. The soils are developed on a range of parent materials including underlying igneous and metamorphic rocks, limestone, shale, sandstone, gypsum beds, and alluvial and eolian deposits.

Several soil types are represented in the Planning Area. The soils are typically well drained to excessively drained. The profiles range from deep, nearly level to gently sloping silt and silty clay loam soils developed on low lying areas, to shallow, moderately steep to steep calcareous gravels and gravelly loam soils developed on upland features.

Erosion caused by water and wind processes is a primary consideration in the Planning Area. Susceptibility to erosion varies depending on soil type, slope, and vegetation cover. Some of the soils may be classified as prime farmland.

3.6.1 Soil Erosion

The potential for soil erosion is the result of several factors including slope, parent material, vegetation cover, climate, and the physical/chemical characteristics of the soil. The Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) has mapped general and high detail soil units in portions of Sierra and Otero Counties. The NRCS soil survey publications were referenced for this study of the Planning Area. Erosion potential designations of slight, moderate, high, and severe, assigned by the NRCS, are used to indicate how susceptible soils are to increased erosion due to disturbances such as removal of vegetation, construction activities, and vehicular activity.

The most active wind erosion occurs during the spring in dune areas of sandy gypsiferous loam soils typical of the Alamogordo-Gypsum Land-Aztec soils located to the west of Alamogordo and in the Crow Flats area in Otero County, Pintura-Dona Ana sandy soils located in the Orogrande area, Simona-Delnorte-Nickel soils to the east of Engle in Sierra County, and Nickel-Bluepoint and Glendale-Gila-Brazito soils in the Rio Grande Valley of Sierra County.

Soils susceptible to water erosion have the potential to produce high sediment loads in nearby streams. Two independent studies and BLM rangeland inventories conducted within the Planning Area have identified areas of high sediment yield. Soil types susceptible to water erosion in Sierra County include sparsely vegetated Nickel-Bluepoint soils of the Rio Grande Valley and Simona-Delnorte-Nickel soils east of the Caballo Mountains. In Otero County, valley slopes dissected by erosion gullies have been mapped in Holloman-Gypsum Land-Yesum soils in the Crow Flats area and west of Alamogordo. Other generalized soil types exhibiting severe erosive characteristics are Prelo-Tome-Largo soils of the Tularosa River Valley, and Badland soils (mapped as Alamogordo-Gypsum Land-Aztec soils) to the east of Tularosa and Three Rivers in north-central Otero County. Predominant soil types exhibiting highly erosive and fragile characteristics are presented on Map 3-5.

Other areas with soils susceptible to water erosion in the Planning Area include gravelly soils at the base of mountain ranges and steep hillslopes, pediments, alluvial fans; and gravelly sand along river breaks in Sierra County.

3.6.2 Prime Farmland

As defined by the U.S. Department of Agriculture, prime farmland soils have characteristics that are best suited for the economic production of sustained high crop (food, seed, forage, fiber, and oilseed) yields. These soils have a sufficiently long growing season and need only to be treated and managed using acceptable farming methods, which generally result in the least damage to the environment. Prime farmland soils are typically made up of loam, silt, silt loam, and clay loam developed on floodplains. With the availability of a dependable and adequate water supply (e.g., irrigation), some soils in the Planning Area may be suitable as prime farmland. Within the Planning Area, Caballo and Elephant Buttes Reservoirs in the Rio Grande Valley have created a dependable irrigation water source for agricultural development on Glendale-Gila-Brazito type soils of Sierra County. Other diversions from a finite number of smaller rivers and creeks also support prime farmland in Sierra County. Potential prime farmland in Otero County is generally limited to irrigated Prelo-Tome-Largo soils along the Tularosa River and on irrigated lands within the Crow Flats area. Map 3-5 shows areas within the Planning Area capable of prime farmland development including nonirrigated areas. The NRCS publications further delineate high detail soil types capable of supporting prime farmland development.

3.7 WATER RESOURCES

3.7.1 Groundwater

The Planning Area is characterized by north-trending, sub-parallel mountain ranges separated by basins filled with alluvial material. Some of the basins may contain up to 9,000 feet of basin-fill, but the most permeable layers and most of the recoverable groundwater is in the upper 1,000 feet of the basin units. The basin-fill material is important in the consideration of regional groundwater supplies (BLM 1984).

There is an increasing need for groundwater in the Planning Area for rangeland and municipal uses. In order to protect existing groundwater from impairment, 11 underground water basins (for which all or part are within the Planning Area) have been "declared" by the State Engineer (New Mexico Water Quality Control Commission [NMWQCC] 1996). The declared basins include the Rio Grande, Lower Rio Grande, Hot Springs, Las Animas Creek, Tularosa, Nutt-Hockett, Mimbres Valley, Hondo, Hueco, Penasco, and Gila-San Francisco Declared Basins (BLM 1984). The area located in

southeastern Otero County has not been declared and is referred to as the "undeclared basin." Map 3-6 illustrates the location of the declared and undeclared basins in the Planning Area.

Groundwater in the Planning Area occurs in valley-fill deposits, basin-fill deposits, and in consolidated rock. Valley-fill aquifers consists of floodplain and channel deposits of the major rivers such as the Rio Grande and its tributaries. Groundwater can be found as shallow as 10 feet (3 meters) below surface in the valley-fill aquifers in the Rio Grande Valley. Recharge occurs by precipitation and movement of water from rivers toward the aquifers. Discharge occurs by evapotranspiration and groundwater withdrawals (Anderholm et al. 1995).

The basin-fill aquifers consist mainly of unconsolidated to semi-indurated sedimentary deposits. The material is generally of Quaternary and Tertiary ages and ranges from poorly sorted to moderately sorted mixtures of gravel, sand, silt, and clay from consolidated rock in the nearby mountain ranges. Evaporite deposits, limestone, conglomerate, and volcanic rocks are present in places. Most of the groundwater occurs under water-table (unconfined) conditions; however, due to the wide range in permeability of the basin deposits, some groundwater occurs under artesian conditions. Groundwater in the basins is primarily recharged by ephemeral streams draining the surrounding mountains and discharging either across the permeable alluvial fans at the mouths of the steep canyons or by underflow in these canyons, which enters the alluvial fan directly. Discharge can occur by evapotranspiration, movement to rivers and streams, groundwater withdrawals, or through springs emerging at the surface (BLM 1984).

As part of a comprehensive geographic approach to protect all the State's water resources, the NMWQCC recognizes 11 distinct water quality basins in the State, which are identified mainly by surface hydrology. Several of these basins are considered "closed" basins, meaning that each basin completely contains all the surface flows within its boundaries (NMWQCC 1996). One of the closed basins, the Central Closed Basin, occupies the majority of the Planning Area, with the exception of the extreme western end of Sierra County and the northeastern section of Otero County. The Central Closed Basin impacts groundwater quality in the Planning Area because saline groundwater results from the concentration of salts by evaporation in the topographically lower parts of the closed basin (Garza and McLean 1971).

Consolidated rock in the Planning Area consists mostly of sedimentary and volcanic rock, with lesser amounts of metamorphic and igneous rock. This rock makes up the mountain ranges that border the basins and is the principal source of sedimentary material in the basin-fill deposits. Consolidated rock typically exhibits very low permeability and very low rates of groundwater flow. Well yields in consolidated rock are generally low and occur by interception of water in fracture zones (Brady et al. 1984).

Hydraulic conductivity is relatively large in the coarse-grained alluvial fan deposits near the mountain fronts of the basins. Fine-grained fan deposits and lacustrine deposits basin-wide are characterized by

relatively small hydraulic conductivity. Large ratios of horizontal to vertical hydraulic conductivity are due to discontinuous, thinly bedded clay units throughout much of the basin-fill deposits (Garza and McLean 1971).

Depth to groundwater in most of the Planning Area is less than 500 feet (152 meters). Two areas of Sierra County contain groundwater at depths greater than 500 feet (152 meters), located at the extreme western and eastern edges of the County. Three areas in Otero County also contain groundwater at depths greater than 500 feet (152 meters)—two areas located at the northern end of the County and one larger area located to the south (Brady et al. 1984). More comprehensive information can be found in individual basin reports available for review at the Las Cruces Field Office of BLM.

Approximately 90 percent of the population of the State depends on groundwater for its drinking water. Nearly one half of the total water used for all purposes in New Mexico is groundwater. In many locations groundwater is the only available water supply and the Planning Area is no exception (NMWQCC 1996).

The NMWQCC has regulations in place controlling discharges onto or below the surface of the ground to protect all groundwater that has an existing concentration of 10,000 milligrams per liter (mg/L) or less of total dissolved solids. The NMWQCC has established a set of numeric groundwater standards based on the regulations governing groundwater. Groundwater quality in the Planning Area is highly variable depending upon the types of soluble minerals found in the water-bearing strata of the individual basins (BLM 1984).

The New Mexico Environment Department maintains an inventory of known groundwater contamination cases in the State. Records indicate that both public and private water supply wells have been impacted by contamination. The NMWQCC has identified both point source and nonpoint source contamination in groundwater of the Planning Area. Factors affecting aquifer vulnerability include preferential flow pathways, clay and organic matter content of soils, and oxidation-reduction potential. Portions of aquifers located in the Planning Area are considered highly vulnerable to contamination from surface water discharges in areas of a shallow water table where the vadose zone is highly fractured. Further information on aquifer vulnerability can be located at the NMWQCC office in Santa Fe (NMWQCC 1996).

Most of the groundwater in the Planning Area is used for municipal, industrial, military, agricultural, rural domestic, and livestock purposes. The primary use of water on the public rangeland is by livestock and wildlife. Most of the water provided for this purpose is depleted either as (1) water consumed by animals, or (2) evaporation from facilities constructed to furnish water supplies. These facilities include storage tanks and troughs that hold water from windmills and springs, and earthen stock tanks that generally receive water from surface sources (BLM 1984).

The State Engineer's Office (SEO) has summarized water use in Sierra and Otero Counties for 1995. In both counties, nine major uses of water include public water supply, domestic, irrigated agriculture, livestock, commercial, industrial, mining, power, and reservoir evaporation (SEO 1999a).

In Otero County, the lowest groundwater withdrawal rate was for mining (20 acre-feet/year), and the highest rate was for irrigated agriculture (29,219 acre-feet/year). There were no withdrawals for power and reservoir depletion uses. The lowest groundwater depletion rate in Otero County was for mining (4 acre-feet/year), and the highest rate was for irrigated agriculture (23,767 acre-feet/year) (SEO 1999a).

In Sierra County, the lowest groundwater withdrawal rate was for mining (18 acre-feet/year), and the highest rate was for irrigated agriculture (15,013 acre-feet/year). There were no withdrawals for commercial, power, and reservoir evaporation uses. The lowest groundwater depletion rate in Sierra County was for mining (4 acre-feet/year), and the highest rate was for irrigated agriculture (9,796 acre-feet/year) (SEO 1999a).

Appendix C summarizes various information for the undeclared basin and the declared basins including aquifers, water quality, and problems. Information on water quality and quantity with the basins has been gathered from various sources and is more extensive for some basins than others. Additionally, not all basins have had basin-wide studies conducted but rather smaller studies on local groundwater occurrence.

3.7.2 Surface Water

The Planning Area consists of major portions of three closed hydrologic basins—Jornada del Muerto, Tularosa Basin, and Salt Basin—and minor parts of the Mimbres and Pecos River closed basins. Closed basins completely contain all surface water flow within their boundaries (NMWQCC 1975). The remainder of the Planning Area is located within an approximately 50-mile segment of the Rio Grande hydrologic basin. These hydrologic basins are shown on Map 3-6.

Occurrence and quality of surface water varies greatly and is unevenly distributed across the Planning Area (Weir 1965). Perennial streamflow is limited to the Rio Grande and streams that drain the mountains along the eastern boundary of the Tularosa Basin. In addition, water occurs as seeps and springs across the Planning Area, sometimes at the headwaters of perennial flows or more often appearing as minor contributing flows to the streams (Garza and McLean 1971).

Only the large drainage areas have appreciable baseflow, which is derived largely from groundwater. Part of the total annual snowmelt and storm runoff recharges the alluvium aquifers throughout the basins (Garza and McLean 1971). Overall, tributaries flow mainly during storm events but quickly cease to flow due to loss by infiltration to the alluvium and by evaporation (Ellis 1991). The closed basins contain playas that form ephemeral lakes during rainy periods and alkali flats upon drying (BLM 1981a).

Surface water storage reservoirs also occur in the area. These include the Elephant Butte Reservoir, used for irrigation storage and hydroelectric power generation, and Caballo Reservoir used for irrigation storage. Both reservoirs are located on the Rio Grande in Sierra County. There are no rivers or segments of rivers in the Planning Area that are designated as wild and scenic.

Floodplains are land areas susceptible to being inundated from any source and include small and often dry water courses and areas along rivers, streams, and lakes. Floodplains are delineated on Flood Insurance Rate Maps and Flood Hazard Boundary Maps issued by the Federal Emergency Management Agency (FEMA) on a county-wide basis. Floodplain management is covered by Executive Order 11988 (42 CFR 26951, 1977) and BLM Manual 7221.

3.8 AIR QUALITY

Generally, the air quality in the Planning Area is good. The air quality does not exceed State or Federal ambient air quality standards. There are several Prevention of Significant Deterioration Class I areas adjacent to or near the Planning Area. In Otero County, the Guadalupe Mountains National Park in Texas are adjacent to the Planning Area to the south, the Carlsbad Caverns National Park are approximately 10 miles east of the Planning Area, and the White Mountain Wilderness Area is approximately 3 miles north of the Planning Area. In Sierra County, Bosque del Apache Wildlife Refuge (Wilderness Area) is approximately 13 miles north of the Planning Area, and the Gila Wilderness Area is approximately 10 miles west of the Planning Area. These Class I areas have more restrictive air quality permitting requirements. The remainder of the Planning Area is designated as PSD Class II.

Currently, the State of New Mexico has only one monitoring station located in Sierra and Otero Counties. This monitoring station only records data for particulate matter of 10 microns or less (PM_{10}) and is located in La Luz, approximately 5 miles north of Alamogordo, New Mexico.

The most recent data (March 1999) list the highest 24-hour concentration recorded in the past year as 70 micrograms per cubic meter ($\mu g/m^3$). The second highest 24-hour value is 41 $\mu g/m^3$. The average of the 10 highest readings in the past year is 34 $\mu g/m^3$ (U.S. Environmental Protection Agency 1999).

The lower Rio Grande Valley near the urban areas of Las Cruces, New Mexico; El Paso, Texas; and Juarez, Mexico have generally poor air quality. Portions of the urban area of El Paso are classified as nonattainment for several pollutants. These include particulate matter of 10 microns or less (moderate), ozone (serious), and carbon monoxide (moderate). These events of poor air quality are more likely to occur in the winter when temperature inversions prevent the transport and dispersion of pollutants. Polluted air has the potential to travel up the Rio Grande Valley and north via the Tularosa Basin into portions of the Planning Area. Blowing dust also contributes to air pollution events especially during the windy spring months. Dry, sparsely vegetated soils and unpaved roads are the main sources of particulate matter.

3.9 NOISE

Noise is generally defined as unwanted or annoying sound that is typically associated with human activity and interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, perceived importance of the noise and its appropriateness in the setting, time of day and type of activity during which the noise occurs, and sensitivity of the individual. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB). Most of the sounds one hears in the environment do not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate sound. The method commonly used to quantify environmental sounds involves evaluating all of the frequencies of a sound according to a weighting system which reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). A sound level range of 0 to 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Although the A-weighted sound level may provide an adequate indication of the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources that create a relatively steady background noise in which no particular source is identifiable. A single descriptor called the Leq (equivalent sound level) is used. Leq is the energy-mean A-weighted sound level during a measured time interval. It is the “equivalent” constant sound level that would have to be produced by a given source to equal the fluctuating level measured. Leq(h) is the one-hour equivalent sound level.

Day-night noise level (Ldn) is the weighted 24-hour average sound level. It is calculated by adding 10 decibels to the sound level at night (10:00 p.m. to 7:00 a.m.). The penalty is added to account for the increased sensitivity to noise during the quiet nighttime hours. Sound levels of typical noise sources and noise environments are presented in Table 3-5.

3.9.1 Existing Noise Environment

The Planning Area is primarily undeveloped with vast open spaces. Land uses vary from sparsely populated rural regions to residential, commercial, and public uses in various small communities within Sierra and Otero Counties. Portions of the Planning Area consist of recreational (hiking, camping, rockhounding, birdwatching, hunting, and off-road vehicles) and agricultural (livestock and crop production) uses. The primary uses on public land are livestock grazing and mining, mineral material excavation, and dispersed recreation.

Baseline ambient hourly sound levels typically range from 35 to 70 dBA depending on the population density, distance to county and State roads, U.S. highways, and commercial and industrial noise sources (Dames & Moore, from numerous project sound level measurements). In some areas, noise from military aircraft overflights from various bases and other activities contribute to the noise environment.

3.10 VEGETATION

Information on the existing vegetation within Sierra and Otero Counties was obtained from BLM sources, including the *White Sands Resource Area Management Situation Analysis* (BLM 1984), *White Sands Resource Area Draft Resource Management Plan/Environmental Impact Statement* (BLM 1985b), and from Dick-Peddie (1993).

Eight major physiognomic vegetation types were identified for Sierra and Otero Counties including grasslands, desert scrub, montane scrub, woodland/forest, arroyos, malpais, riparian/other wetlands, and other (cropland). These major vegetation types are shown on Map 3-7. Grasslands and desert scrub occupy the greatest area. Factors such as soils, topography, elevation, temperature, and precipitation have a direct influence on the distribution of vegetation occurring on the various sites. Six ecological study plots have been established in BLM's Decision Area. These areas are subject to more stringent surface use management in the current RMP in order to protect resource values (native species, especially grasses).

Three vegetation types have been identified as particular concerns due to their habitat value for special status species: grasslands, woodlands forest, and riparian types.

TABLE 3-5
SOUND LEVELS OF TYPICAL NOISE SOURCES AND NOISE ENVIRONMENTS
(A-WEIGHTED SOUND LEVELS)

Noise Source (at a Given Distance)	Scale of A-Weighted Sound Level in Decibels	Noise Environment	Human Judgment of Noise Loudness (Relative to a Reference Loudness of 70 Decibels[a])
Military jet take-off with after-burner (50 feet [15 meters]) Civil Defense siren (100 feet [30 meters])	140 130	Carrier flight deck	
Commercial jet take-off (200 feet [61 meters])	120		*Threshold of pain* 32 times as loud[a]
Pile driver (50 feet [15 meters])	110	Rock music concert	16 times as loud[a]
Ambulance siren (100 feet [30 meters]) Newspaper press (5 feet [1.5 meters]) Power lawn mower (3 feet [0.92 meter])	100		*Very loud* 8 times as loud[a]
Motorcycle (25 feet [7.6 meters]) Propeller plane flyover (1,000 feet [305 meters]) Diesel truck, 40 mph (50 feet [15 meters])	90	Boiler room Printing press plant	4 times as loud[a]
Garbage disposal (3 feet [0.92 meter])	80	High urban ambient sound	2 times as loud[a]
Passenger car, 65 mph (25 feet [7.6 meters]) Living room stereo (15 feet [4.6 meters]) Vacuum cleaner (3 feet [0.92 meter]) Electronic typewriter (10 feet [3 meters])	70		*Moderately loud* 70 decibels[a] (Reference loudness)
Normal conversation (5 feet [1.5 meters]) Air conditioning unit (100 feet [30 meters])	60	Data processing center Department store	one-half as loud[a]
Light traffic (100 feet [30 meters])	50	Private business office	one-quarter as loud[a]
Bird calls (distant)	40	Lower limit of urban ambient sound	*Quiet* one-eighth as loud[a]
Soft whisper (5 feet [1.5 meters])	30 20 10 0	Quiet bedroom Recording studio	*Just audible threshold of hearing*

SOURCE: Compiled by Dames & Moore from numerous sources including but not limited to Federal Transit Administration 1995, General Radio 1972, Harris 1991, U.S. Department of Housing and Urban Development 1977, U.S. Environmental Protection Agency 1980.

3.10.1 Grasslands

Grasslands occur throughout the Planning Area at all elevations, and generally habitats consist of grass flats (low swales that receive flood overflow), grass hills, grass rolling uplands (nonswale, isolated pocket settings), and grass mountains (slopes of mountain ranges above the surrounding uplands). Grasslands cover approximately 1,849,277 acres in the Planning Area and 585,831 acres in BLM's Decision Area. Salt flats, or playas, occur within the Planning Area and have been identified by the BLM as resources of concern because these areas are sensitive to surface disturbance (e.g., wind erosion on salt flats, playas as spring habitat for shore and wading birds). Droughts are common in these regions and must be anticipated in management practices.

The predominant species in lower elevations include black grama, blue grama, tobosa, alkalai sacaton, burrograss, sand dropseed, mesa dropseed, ring muhly, and fluffgrass. In higher elevations, curl-leaf muhly, black grama, three-awns, sideoats grama, mountain muhly, spike muhly, and needle and thread predominate. Grasslands on sandy soils that contain dropseed, alkali sacaton, and Indian rice grass are designated as mid grass vegetation.

Encroachment of desert scrub onto grasslands has been occurring over the past 80 to 90 years. This shift may be attributed to a combination of climatic change, introduction of roads, extensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975; Neilson 1986). Grass species that are highly palatable, such as black grama, provide a highly desirable livestock forage. Of particular concern are two remnant areas of desert grassland patches within BLM's Decision Area, which provide habitat for pronghorn (and coincide with the Otero Mesa Habitat Management Area and Nutt Antelope Area).

3.10.2 Woodland/Forest

Woodland/forest vegetation types are found at the higher elevational limits of the Planning Area, which receive the greatest amounts of precipitation. These species occupy shallow soils and are predominantly on the north-facing slopes of the mountains and hills. Woodland/forest habitat types are associated primarily with the Caballo, Sacramento, San Andres Mountains, and Black Range, and habitats consist of piñon-juniper woodlands (generally on mountain ranges about 6,000 feet), montane coniferous forest (on mountain ranges between 8,000 to 10,000 feet), and subalpine coniferous forest (on mountain ranges between 9,500 and 12,000 feet). Woodlands/forests occur on approximately 1,849,304 acres in the Planning Area and 118,626 acres in BLM's Decision Area.

While juniper usually is not considered a desirable species, the trees in this area do not form a continuous canopy, but are in scattered clumps that provide wildlife cover. The piñon provides food for wildlife, and several species of browse plants also provide excellent deer habitat.

Understory vegetation consists primarily of grasses, blue grama, black grama, sideoats grama, algerita, and galleta. This also represents higher average elevations and should be considered a transition zone as reflected by the presence of ponderosa pine, Gambel oak (oakbrush), serviceberry, and some of the ash species.

Besides providing forage, uses of these areas that should be considered in any management program include the use of trees for posts and firewood, and the management of piñon stands for greater production of nuts.

3.10.3 Riparian/Other Wetlands/Playas

The riparian vegetation type currently identified within BLM's Decision Area accounts for approximately 14.5 miles along creeks and surrounding seeps and springs. It is very important as a habitat type. In addition, arroyos, playas, and salt flats are likely to be classified as Waters of the United States and therefore subject to Section 404 of the Clean Water Act. Within BLM's Decision Area, there are approximately 3,351 acres of playas identified. Intermittent streams, mud flats, and sand flats also are considered Waters of the United States. Some of the larger, more important riparian areas in the Planning Area include the Elephant Butte and Caballo Reservoirs and along the Rio Grande, the south fork or Palomas Creek, Berrenda Creek, Tularosa River, and Percha Creek.

Riparian vegetation along the Rio Grande consists of dense stands of trees and shrubs that form "bosques" (Dick-Peddie 1986). The composition ranges from pure stands of salt cedar, bank willow, and willows mixed with mesquite and four-wing saltbrush. Open areas usually are dominated by saltgrass with seep willow on the perimeters. Cottonwood trees are scattered along the Rio Grande and dominate the bosques in some areas, but usually contain tree willow.

These areas can provide excellent food and cover for wildlife and smaller game animals. Generally water is plentiful in these areas and more reliable for wildlife as well as livestock.

3.10.4 Noxious Weeds

The major poisonous plants that occur in the Planning Area are locoweed, mustard, and milkweed. Primary plants that are undesirable for livestock include oak, mustards, cocklebur, and snakeweed.

Noxious weeds that are listed for the BLM Las Cruces Field Office (1996a, 1997a) include Russian knapweed (*Centaurea repens*), hoary cress (*Cardaria draba*), Canada thistle (*Cirsium arvense*), Malta starthistle (*Centaurea melitensis*), leafy spurge (*Euphorbia escula*), musk thistle (*Carduus*

nutans), yellow starthistle (*Centaurea solstitialis*), and African rue (*Peganum harmala*). Because of the invasive nature of these plant species, and an increasing dominance at the expense of economically important native species, land management policies should be cognizant of activities that facilitate the spread of weeds, and conversely, of measures that help prevent infestations and spread of these noxious species.

Noxious weed distribution was mapped for Otero County by the Natural Resource Conservation Service. Infestations of African rue occur east and southeast of Alamogordo along U.S. Highway 54 and also east of this highway between Alamogordo and Tularosa. Russian knapweed also occurs in this area, but mostly between Alamogordo and Tularosa. Other noxious weed species are less pronounced, having more scattered distributions. The exception is a concentration of common burdock east of Alamogordo.

3.11 WILDLIFE

Information regarding wildlife species that are present within the Planning Area was gathered from the BLM and NMDGF. The BLM maintains an inventory of wildlife in the Integrated Habitat Inventory and Classification System (IHICS). The IHICS is designed to assist in accumulating, storing, retrieving, and analyzing data on wildlife, as well as on vegetation, soils, landforms, climate, and other ecosystem determinants as they relate to wildlife resources. Inventories were conducted for the *White Sands Resource Area Management Situation Analysis* (1984). Selected habitat sites were sampled for vertebrate species for the *Draft Grazing Environmental Impact Statement for the Southern Rio Grande Planning Area* (BLM 1981b). The Southern Rio Grande Planning Area includes parts of Sierra, Luna, and Dona Ana Counties.

3.11.1 Standard Habitat Types

Wildlife in the Planning Area is associated with specific habitat types (SHS) as identified by the BLM. These SHSs are delineated according to the vegetation type present, landforms, and soil types. For the purposes of this document, the SHSs have been combined into seven groups under broader habitat type definitions. These groupings are based on similarities in vegetation between SHSs. Table 3-6 provides a list of which SHSs are within each group. Several SHSs are found in both Sierra and Otero Counties, while others are limited to only one area, as indicated on Table 3-6. Map 3-7 depicts the broader vegetation types. Several key habitat types are discussed in Section 3.10 and additional information is available in Appendix D-III and the MSA.

There have been changes in the distribution and amount of each habitat type over time resulting from human activities such as livestock grazing, road construction, and the introduction of exotic (non-native) species. It is estimated that overall there has been a 37 percent increase in creosote-dominated habitat

types, a 2 percent increase in half-shrub types, a 7 percent increase in mesquite-dominated types, and a 17 percent increase in mixed shrub habitat type (Howard, personal communication, 1999). These types generally have resulted in an overall loss (62 percent) of grasslands, which are preferred by many wildlife species.

The SHSs are an important wildlife management tool for the BLM. The BLM maintains lists of vertebrate species associated with each of the SHSs. These lists differ slightly between counties depending on specific habitat features within each SHS.

TABLE 3-6
HABITAT TYPES IN SIERRA AND OTERO COUNTIES

Type	Standard Habitat Sites	Acres	
		Planning Area	Decision Area
Grasslands	Grass Flat (S,O) Grass Hill (O) Grass Mountain (S,O) Grass Rolling Upland (S,O) Half-Shrub Hill Half Shrub Rolling Upland (S) Salt Flat (O)	1,849,277	585,831
Desert Scrub	Creosote Breaks (S) Creosote Hills (O) Creosote Rolling Upland (S,O) Mesquite Rolling Upland (S,O) Mesquite Sand Dune (S,O) Mixed Shrub Rolling Upland (S)	2,774,236	1,183,512
Montane Scrub	Mixed Shrub Montane (S)	56,424	25,000
Woodland/Forest	Piñon-Juniper Grass Mountain (S,O)	1,849,304	118,626
Arroyo	Arroyo (S,O)	38,295	21,335
Malpais	Malpais Rock (S)	32,969	54
Riparian/Wetlands/Playas	Riparian (S,O)	14,390	5,762
Unclassified and Miscellaneous Vegetation Types	(Alpine Tundra [O] Sand Dunes [S])	334,064	112,959
Total Acres		6,949,557	2,053,029

SOURCE: Bureau of Land Management 1999a, b
NOTE: S = Sierra County; O = Otero County

3.11.2 Wildlife

Big Game

Pronghorn and mule deer occur throughout the Planning Area and utilize several of the SHSs listed above. Two elk herds are present in the Planning Area. The NMDGF tracks these animals and maintains information about total animal populations, habitat and population trends, areas of critical

habitat, winter range, and areas of population concentrations. The wildlife habitat map (Map 3-7) delineates the boundaries of five habitat areas.

Pronghorn inhabit the Otero Mesa Management Area on Otero Mesa in Otero County and the Nutt Antelope Area east of SR 85 in Sierra County. Pronghorn are associated most commonly with grass flats, grass hills, and grass rolling uplands. The two habitat areas are desert grassland patches, which are remnants of a habitat type that was more dominant historically. However, degradation and conversion to desert scrub has been occurring over the past 80 to 90 years as a combined result of climatic change, introduction of roads, extensive livestock grazing, and concurrent interruption of naturally occurring fire.

The Caballo Mountains Deer Habitat Area, Sacramento Escarpment Deer Habitat Area, and Jornada del Muerto Habitat Area support deer populations and have been identified by the BLM as resources of concern. There are few habitat sites within the Planning Area that provide the biological requirements for significant numbers of big game species other than those mentioned above; however, infrequent occurrences of elk, bear, turkey, and mountain lion have been recorded. Elk move onto McGregor Range, although most elk in the area are year-round residents. No defined winter or calving areas are present (Massey, personal communication, 1999). Elk and bear occasionally are seen in the Brokeoff Mountains and along the lower elevations of the Sacramento Mountains, Guadalupe Mountains, and Black Range; however, these areas are not essential to either elk or bear population viability because of more suitable habitat located outside of the Planning Area. Turkey have been seen in the areas mentioned above with the exception of the Brokeoff Mountains. Habitat for turkey is not essential in any of these areas for the same reasons as for those of elk and bear. Mountain lions occur predominantly in the more rugged mountainous areas of the Brokeoff, Sacramento, Guadalupe, San Andres, and Caballo Mountains and Black Range. Locations and numbers of mountain lion at any one time are dependent on the presence of prey species, which in turn is related to the suitability of the habitat for prey.

The NMDGF has developed goals for increasing the existing populations of desert bighorn sheep. These goals are documented in *New Mexico's Long Range Plan for Desert Bighorn Sheep Management 1995-2002* (NMDGF 1995). Potential reintroduction sites for the bighorn are located within the Planning Area. Sites with suitable habitat parameters for bighorn sheep are located in the Caballo, Sacramento, and Guadalupe Mountains. Secondary reintroduction sites include the Brokeoff and Cornudas Mountains (Massey, personal communication, 1999). The Caballo Mountains provide a potential movement corridor for bighorn sheep from the Fra Cristobal Mountains (Snyder, personal communication, 1999).

Small Game

Major species of upland game birds include Gambel's quail, scaled quail, and mourning dove. Gambel's quail occur in the more mesic habitat sites, whereas scaled quail utilize those that are more xeric. Population numbers of quail, both Gambel's and scaled, fluctuate depending in part on precipitation and quality of habitat. Mourning dove occur throughout the Planning Area with concentrations favoring those areas where water is present. Jackrabbits and cottontail rabbits also are common in the area, utilizing most habitat sites (BLM 1985b).

Nongame

Many nongame species including raptors, small mammals, birds, reptiles, and amphibians, occur throughout the Planning Area. Lake Holloman, a man-made impoundment, provides a perennial source of freestanding water and receives use from a variety of shorebirds.

Raptors

Raptors (eagles, hawks, and owls) are common throughout the Planning Area. Wintering raptors often are associated with habitats associated with water and open grassland areas where prey species are abundant. Raptors that are associated with several SHSs within the Planning Area include sharp-shinned hawk, prairie falcon, Cooper's hawk, red-tailed hawk, Swainson's hawk, ferruginous hawk, and golden eagle. Bald eagles winter in the area, roosting in the mountains near water and foraging into the surrounding lower elevations. Owls in the area include great-horned owl, western screech owl, long-eared owl, and northern pygmy owl.

Waterfowl

Waterfowl occurrences in the Planning Area are limited to those habitat sites where freestanding water is available. Earthen stock tanks are utilized seasonally; however, habitat along the Rio Grande, and in Caballo and Elephant Butte Reservoirs and Lake Holloman, is more abundant and desirable. The Rio Grande corridor is a major migration route for waterfowl, raptors, and passerines.

Fisheries

Fisheries in the Planning Area include Caballo Reservoir, Elephant Butte Reservoir, portions of the Rio Grande, Three Rivers, and Tularosa Creek. Records indicate that Three Rivers contains some

concentrations of brook trout, which is the sole species known to occupy this aquatic habitat. The Tularosa Creek contains both rainbow and brown trout.

3.12 SPECIAL STATUS SPECIES

An estimated 10 Federally listed threatened and endangered species and 45 other special status species (Federal candidate, Federal proposed, BLM sensitive, and State-listed) are known or potentially could occur on public land within the Planning Area. A list of the special status species in the Planning Area and on public land is provided in Appendix D-I. Special status species accounts for those species most likely to occur on public lands are provided in Appendix D-II. Some special status species are dependent on specific habitats. Other species have an extremely restricted distributional range and are known as endemic species; a variety of endemic species are present within Sierra and Otero Counties. Many of the more mobile species (birds, large mammals) can use several different habitat types. Appendix D-III provides a list of the special status species that are most likely to occur in BLM's Decision Area.

The following sections describe the (1) special status species that potentially could occupy the general habitat types in the Planning Area, (2) endemic species, and (3) six special status species (SSS) areas on public land.

3.12.1 Special Status Species Habitats

The variety of habitats in Sierra and Otero Counties (see Map 3-7) provide important environments (for growth, foraging, cover, and reproduction and rearing) for a number of special status species. Of these habitat types, grasslands, riparian, and woodland/forest habitats are the most important to special status species. The species associated with each of the important habitat types are summarized briefly below.

Grasslands

A number of special status species are dependent on grassland habitats including Guadalupe rabbitbrush, grama grass cactus, aplomado falcon, black-footed ferret, mountain plover, Arizona black-tailed prairie dog, Baird's sparrow, ferruginous hawk, and western burrowing owl.

Woodland/Forest

A number of species are dependent on woodland/forest habitats and include Glass Mountain coral root, Kuenzler hedgehog cactus, Todsen's pennyroyal, gray-footed chipmunk, Mexican spotted owl, northern goshawk, Sacramento Mountain salamander, and numerous bat species (foraging and roosting).

Riparian

Species dependent on riparian habitat types include Sacramento prickly poppy, Sacramento Mountains thistle, Wright's marsh thistle, brown pelican, interior least tern, whopping crane, southwestern willow flycatcher, bald eagle, Chiricahua leopard frog, Arizona southwestern toad, black tern, New Mexico jumping mouse, northern goshawk, white-faced ibis, yellow-billed cuckoo, and numerous bat species (foraging for insects).

3.12.2 Endemic Species

A variety of endemic species, or species whose occurrence is restricted to a small area, are present within Sierra and Otero Counties. These endemic species and their area of occurrence (listed in parentheses) are as follows: Sacramento prickly poppy (Sacramento Escarpment); Sacramento Mountain thistle (Sacramento Mountains); Villard's pincushion cactus (Sacramento Escarpment); Guadalupe Mountain mescal bean (Brokeoff Mountains); Duncan's cory cactus (Mud Mountains in New Mexico, but also present in Big Bend National Park in Texas); gypsum scalebroom (Alkali Lakes in New Mexico and Texas); Todsen's pennyroyal (San Andres Mountains on west side of Tularosa Basin and Sacramento Mountains on east side of Tularosa Basin); gypsum ringstem (Pup Canyon); gypsum blazingstar (Pup Canyon); Sierra Blanca cliffdaisy (Sacramento Mountains); Mineral Creek Mountain snail (Mineral Creek), Cornudas Mountain land snail (Cornudas Mountains); Organ Mountain Colorado chipmunk (Organ Mountains); White Sands pupfish (White Sands Missile Range).

The table in Appendix D-III provides a list of the special status species that are most likely to occur in BLM's Decision Area within standard habitat types.

3.12.3 Nominated ACECs

Eight areas in BLM's Decision Area have been nominated to become ACECs (Dunmire 1992, BLM 1999b). The nominations are based primarily on the presence of special status species. The nominated ACECs are shown on Map 3-8 and listed is Section 3.18.3.

3.13 RANGELAND

Rangeland within the Planning Area occurs on private land and lands administered by State, Forest Service, Mescalero Apache Indian Tribe, and BLM. Grazing use is primarily by cattle, sheep, and horses. BLM authorizes grazing on approximately 805,640 acres of public land in Sierra County and approximately 933,269 acres of public land in Otero County (BLM 1998a).

Range production for livestock, described as *Acres Per Animal Unit – Yearlong*, has been described and categorized for the Planning Area. *Acres Per Animal Unit – Yearlong* is defined as the number of acres required to support one cow-calf unit for one year. Range production categories vary from a relatively high level of production as in Class B (37 to 43 acres per animal unit – yearlong) to relatively low areas of production as in Class G and H (265 or greater acres per animal unit – yearlong). Table 3-7 lists the range production classes and the number of acres within each of the classes in the Planning Area. Class E (75 to 119 acres per animal unit - yearlong) contains the largest number of acres (3,168,000 acres) while Class B (37 to 43 acres per animal unit) has the smallest number of acres (7,000 acres).

TABLE 3-7
RANGELAND PRODUCTION CLASSES AND ACREAGES

Range Production Classes	Acres/Animal Unit Yearlong	Head/Section Yearlong	Approximate Acres
Class B	37 to 43	17.30 to 14.80 head	7,000
Class C	44 to 54	14.55 to 12.08 head	572,000
Class D	55 to 74	11.64 to 8.65 head	1,799,000
Class E	75 to 119	8.30 to 5.98 head	3,168,000
Class F	120 to 264	5.33 to 2.42 head	1,061,000
Class G	265 and more (high elevations)	8 head or less (high elevations)	112,000
Class H	265 and more	3 head or less	227,000

SOURCE: Department of Agricultural Economics and Agricultural Business, Agricultural Experiment Station, and New Mexico State University, n.d.

More productive areas, such as Class C, occur along the southern end of the Sacramento and Brokeoff Mountains, and the foothills to the east of the Black Range and Mimbres Mountains. Least productive areas, such as Class G and H, occur in the Black Range, Malpais, and portions of the White Sands Missile Range.

On public land, there are 248 grazing allotments in Sierra and Otero Counties. Acreage and forage allocation by allotment for Sierra and Otero Counties are on file at the Las Cruces Field Office of BLM.

3.14 CULTURAL RESOURCES

BLM defines a *cultural resource* or *cultural property* as:

> a definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups (BLM Manual 8100, *Cultural Resource Management*)

No systematic, complete inventory of cultural resources has been undertaken in either Sierra or Otero County, but thousands of archaeological and historical sites have been recorded.

3.14.1 Cultural History

More than seven decades of intermittent research has demonstrated that human societies have occupied the Planning Area for approximately 12,000 years, and perhaps substantially longer.
The earliest occupants, whom archaeologists call Paleoindians, occupied the region from about 10,000 to 6000 or 7000 BC. Remnants of the Paleoindian era are rare, because these earliest occupants lived in small groups, left little durable evidence of their presence, and the archaeological evidence that was left has been subject to millennia of erosion.

Archaeologists call the long period from about 6000 or 7000 BC to about AD 200 the Archaic era. Archaic sites are much more common than Paleoindian sites. Sizeable villages of pit houses, probably representing winter settlements of populations that dispersed during other seasons of the year, date from as early as the Keystone phase (4300-2500 BC). Sites with small numbers of pit houses become much more common during the late Archaic era. Corn was being grown as early as about 1000 BC, as evidenced in sites such as Fresnal Shelter in Otero County.

The subsequent period from about AD 200 to about 1400 or 1500 is called the Formative or Ceramic era. Sherds of broken ceramic vessels are extremely durable and are key pieces of archaeological evidence of the Formative era. Ceramic era sites dominate the archaeological record of the region.

Archaeologists classify the Ceramic era sites in the Planning Area as reflecting the Mogollon culture. These sites in Otero County and eastern Sierra County are considered to be part of the Jornada branch of the Mogollon. Sites in western Sierra County are part of the Mimbres branch.

A Jornada Mogollon village site and numerous images pecked onto boulders (petroglyphs) at Three Rivers in northern Otero County constitute one of the most spectacular archaeological sites on public land in the Planning Area. Other petroglyphs at Alamo Mountain, and clusters of Mogollon archaeological sites at the Jarilla Mountains, Rattlesnake Hill, and Lone Mountain are other major archaeological resources on public land in the Planning Area. The Mogollon cultural system appears to have collapsed in the mid-1400s, or at least changed so drastically that it left an essentially invisible archaeological record.

Very little is known about the peoples occupying the Planning Area when the first Spanish expeditions passed through south-central New Mexico in the 1580s. By the late 1600s, various groups of Apaches moved into southern New Mexico and came to dominate this territory.

Spanish era settlement in New Mexico focused on the Rio Grande Valley well to the north of Sierra and Otero Counties. A major route of travel between Mexico and the New Mexican colony was developed along the Rio Grande at the end of the sixteenth century. The trail, known as the Camino Real or Chihuahua Trail, generally ran adjacent to the river, except for a 90-mile segment known as the Jornada del Muerto. Portions of this trail are on public land in Sierra County.

The Spanish waged campaigns against the Apaches throughout southern New Mexico, but did not settle in the region. The only Spanish settlement in southwestern New Mexico, dating from early in the 1800s, was at the Santa Rita mine in what is now Grant County.

Mexico gained independence from Spain in 1821. Mexican agricultural settlement began expanding north from the El Paso area in the 1840s with the settlement of Dona Ana and Las Cruces in the Rio Grande Valley. At this time Mexico lost New Mexico to the United States as a result of the Mexican War of 1846-1848, and the Gadsden Purchase was ratified in 1854. Remnants of the Cooke's Wagon Road, also known as the Mormon Battalion Trail, created during the Mexican War, are on public land in Sierra County.

The United States invested considerable military efforts to control the Apaches. Fort Thorn and Fort Craig were established in the Rio Grande Valley to the south and north of Sierra County in 1853 and 1854, respectively. In the late 1850s, native New Mexicans cautiously began to expand into the river valley between these forts in what is now Sierra County. Fort McRae, built in 1863 near where Elephant Butte Reservoir is now, provided additional protection, but the Civil War diverted military efforts against the Apaches. Southern New Mexico was part of the Confederacy for about a year from mid-1861 through mid-1862.

By the beginning of the 1870s, relations with the Apaches shifted from hostilities to reciprocal trade and many Apaches were relocated to reservations. The Mescalero Reservation, which is partly in northeastern Otero County, was established in 1873.

Remnants of the "upper route" of the Butterfield Trail, a U.S. Army-protected travel route used prior to August 1859, are on public land in southern Otero County.

Although some discoveries of gold and silver ore were made somewhat earlier than the 1870s, mining in the Planning Area was not seriously pursued until the Apaches were controlled. Discovery of gold and silver in the 1870s and 1880s led to the establishment of numerous mining communities in this area, including Winston, Chloride, Kingston, Hillsboro, and Lake Valley. Lake Valley suffered boom and bust cycles and is essentially a ghost town today, as are virtually all of the mining communities founded in the Planning Area during the nineteenth century. Lake Valley is partially on public land and BLM manages the site for heritage tourism.

Ranching is another major theme of historic Euro-American settlement in the Planning Area, although large-scale cattle ranching dates only from the 1880s, when railroads arrived in the territory.

During World War II the Federal government purchased many large ranches in Otero County and converted them to military ranges. Some of the ranch headquarters abandoned at that time have been recognized as important properties representing the history of ranching. Military training and research remains a primary activity in much of Otero County.

The completion of Elephant Butte Dam on the Rio Grande in 1916 provided more stable agricultural water supplies. Agriculture, particularly the farming of cotton, alfalfa, vegetables, and pecans, along with military training and research, growing trade across the international border, and "Sun Belt" retirement dominate much of the local economy today.

3.14.2 Archaeological and Historical Sites

When the White Sands RMP (BLM 1986a) was prepared, it was estimated that fewer than 250 archaeological and historical sites had been recorded in Sierra and Otero Counties during survey of approximately 50 square miles. The extent of inventory represented only about two percent of the approximately 2,741 square miles of public land within those counties. These data suggested there is an average of almost five sites per square mile, and a total of more than 13,000 archaeological and historical sites on the public land within the Planning Area.

Fifty-one sites within the two counties are listed on the National Register of Historic Places; none occur on public land managed by the BLM. The BLM has been involved in cooperative efforts to list the

Three Rivers Petroglyphs and the historic mining town of Lake Valley, but these nominations are not completed. In addition, the BLM has closed several areas to ORV use to protect cultural resources. These areas include the Rattlesnake Hills Archaeological District, Lone Butte, and Jarilla Mountains.

More than 550 archaeological and historical sites have been recorded during surveys conducted for BLM projects over the last 13 years. This is an average of more than 19 sites per square mile, which is almost four times higher than estimated in 1985. These numbers suggest that there could be more than 50,000 archaeological and historical sites on public land within Sierra and Otero Counties.

The New Mexico Cultural Resource Information System (NMCRIS) has information about approximately 2,200 cultural resource surveys conducted since 1930 within Sierra and Otero counties. More than 1,560 of these surveys have been completed since 1985, with approximately 100 to 150 projects being completed annually since then for an average of about 130 projects per year. These data indicate that BLM projects constitute about 25 percent of the surveys that have been conducted annually within the Planning Area since the White Sands RMP was completed.

Information about the extent of field survey is available for about 2,190 of these projects (92 percent), and it is estimated that they encompassed about 1,130 square miles or approximately 10 percent of the Planning Area. More than 64 percent of the surveys recorded no archaeological or historical sites, but the others discovered an aggregate of 16,059 sites.

The largest surveys were conducted on military facilities in Otero County, including the McGregor Range, White Sands Missile Range, and Holloman Air Force Base. Lesser, but above average, levels of survey seem to be associated primarily with timber sales in the Sacramento Mountains. Few of the large surveys have been conducted on public land managed by the BLM. Although BLM projects account for about 25 percent of the projects conducted since 1985, they encompass only about five percent of the surveyed areas within the Planning Area. However, the BLM projects account for approximately 10 percent of the sites entered into the NMCRIS inventory since 1985. Accordingly, the average of about 19 sites per square mile on post 1985-BLM projects is somewhat higher than the average of about 12 sites per square mile for all NMCRIS surveys. This average suggests there could be a total of approximately 130,000 archaeological and historical sites in the Planning Area. At the rate of survey since 1985, it would take about two centuries to complete the inventory of Sierra and Otero Counties.

In general, the number of recorded archaeological and historical sites correlates with the extent of survey. Therefore the lack of recorded archaeological and historical sites in many parts of the Planning Area does not necessarily mean there are no cultural resources present. Instead, it is much more likely to mean that little survey has been conducted in those areas, and when surveys are undertaken, archaeological and historical sites are likely to be found.

The cultural resource studies conducted in Sierra and Otero Counties, since the White Sands RMP was completed, have recorded more of the types of archaeological and historical sites identified in that RMP. The additional data have refined but not significantly modified the general outline of the cultural history of the region. The White Sands RMP included a map modeling the general variation in the distribution of archaeological and historical sites within the Decision Area. That model still reflects the current understanding of the general distribution of archaeological and historical sites, but is likely to be refined as survey data accumulate.

3.14.3 Traditional Cultural Places and Lifeway Values

No American Indian religious sites or traditional cultural places have been identified within the Planning Area. The Mescalero Apache Reservation is in northeastern Otero County and members of this tribe visit the Three Rivers Petroglyphs and apparently regard it as a sacred place. The hot springs near Truth or Consequences may have been regarded as sacred by the Apache, but these springs do not appear to be part of contemporary sacred or religious practices for any American Indian group.

Other than the Mescalero Apache, the only other Federally recognized American Indian group residing in the immediate vicinity of the Planning Area is Ysleta del Sur Pueblo (Tigua Reservation) southeast of El Paso. The Tortugas and Piro-Manso-Tiwas are Indian/Hispanic communities in the Las Cruces area, but have not been Federally recognized as Indian tribes. Other more distant groups may very well have traditional cultural interests in Sierra and Otero Counties.

In 1996, the BLM, in cooperation with the Forest Service, completed a cultural affiliation study for New Mexico and Arizona cultures in compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) (U.S. Department of Agriculture, Forest Service, Southwestern Region 1996). The purpose of this study was to determine which American Indian groups might claim affiliation to human remains, funerary objects, sacred objects, and objects of cultural patrimony associated with archaeologically defined cultures. The three archaeological cultures relevant for Sierra and Otero Counties include the Jornada Mogollon (AD 200-1400), Upland Jornada Mogollon (AD 500-1450), and Upland Mogollon. No modern American Indian groups were definitely identified as culturally affiliated with either the Jornada or Upland Jornada Mogollon archaeological cultures. The Jornada Mogollon was identified as possibly associated with historic groups in northern Chihuahua that lost their cultural identity or possibly the Piro. The Piro were puebloan villagers who suffered from Apache raiding during the Spanish colonial era. Remnants of this group moved south with the Spanish when they were expelled by the Pueblo Revolt in 1680, and founded Ysleta del Sur Pueblo. The Hopi Tribe, Pueblo of Zuni, and Pueblo of Acoma were determined probably to be affiliated culturally with the Upland Mogollon culture.

3.15 PALEONTOLOGICAL RESOURCES

Sierra and Otero Counties include a broad diversity of geologic formations and structures. The geology map prepared in conjunction with the MSA shows the outcrops or exposures of 90 geologic units in the Planning Area (Anderson et al. 1997). These units are evidence of a long and varied geologic history. Section 3.5 of this document describes the general geology and stratigraphy of the Planning Area.

The geologic units in Sierra and Otero counties range from almost two billion years old to the present (Table 3-8). Almost all fossils are found in sedimentary deposits. Sedimentary rocks form in marine and nonmarine environments and include sandstone, siltstone, shale, and limestone. The rocks of the Precambrian include a complex of gneiss, with metasedimentary and metavolcanic rocks intruded by granites. The formations of the Early Paleozoic include interbedded limestones, sandstones, and shales as well as conglomerates, quartzite, and dolomites. The formations represent approximately 320 million years and are characterized in New Mexico by widespread deposition of primarily marine sediments with invertebrate fossils. Early Paleozoic rocks (pre-Mississippian) crop out in southern New Mexico and are generally sparsely fossiliferous. Rocks of the Early Paleozoic crop out along escarpments of the Sacramento, San Andres, Oscura, Organ, Caballo, and other mountains in southern Arizona. There have not been any confirmed reports of Cambrian vertebrates in New Mexico. A few heterostracan tesserae were found in a glauconitic sandstone at the Virginia Mine in the northern part of the Sacramento Mountains in Otero County. The sandstone is believed to be part of the Cambro-Ordovician Bliss Formation. No Silurian vertebrates are known in New Mexico. There are several reports of Devonian vertebrates (bone beds with abundant ichthyoliths and conodonts) in the Sacramento Mountains. Fossil fish of the Pennsylvanian occur in the Sacramento Mountains. Vertebrate remains have been found in the Bursum Formation but also found in outcrops in Socorro County (Zidek and Kietzke 1993).

The Mesozoic Era is known as the Age of Reptiles, which included dinosaurs. Outcroppings of Triassic-aged rocks are very limited in the area. Although the Triassic Chinle and Moenkopi formations have yielded many fossils of all types, the localities have been in the northern part of the State (Hunt and Lucas 1993a).

There are no Jurassic-aged rocks in southern New Mexico. Outcroppings are limited to the northern part of the State (Hunt and Lucas 1993b).

During the Cretaceous, New Mexico was at the western margin of an epicontinental seaway. A series of transgressive and regressive sequences moved the western shoreline of the seaway between western Arizona and northeastern New Mexico. The most extensive Cretaceous outcrops occur in northern New Mexico but there are exposures in portions of the Planning Area. In Sierra County, the McRae

Formation has yielded skeletal remains of Tyrannosaurus Rex, Alamosaurus, Ankylosauria, and Ceratopsidae (Hunt and Lucas 1993c).

TABLE 3-8
GEOLOGIC TIME LINE

Era	Period	Epoch	Millions of Years Ago
Cenozoic	Quaternary	Holocene	.01
		Pleistocene	2
	Tertiary	Pliocene	5
		Miocene	24
		Oligocene	38
		Eocene	55
		Paleocene	63
Mesozoic	Cretaceous		140
	Jurassic		205
	Triassic		240
Paleozoic	Permian		290
	Pennyslvanian		330
	Mississippian		360
	Devonian		410
	Silurian		435
	Ordovician		500
	Cambrian		570
Precambrian			4500+

SOURCE: American Geological Institute 1999

Cenozoic vertebrates have been found at several localities in Sierra and Otero Counties. Fossil vertebrates have been documented from the Palm Park Formation (Late Eocene) in the Caballo Mountains of Sierra County. The Miocene-Pliocene Santa Fe Group is exposed along both sides of the Rio Grande from Albuquerque to Las Cruces, and has produced diverse fossil fauna of mammals such as camels, gomphotheres (stegomastodons, mastodons), horses, antelope, and many more. There are several sites in the Palomas Formation near Cuchillo Negro Creek in Sierra County. Fossil mammals have been found in the Rubio Peak Formation in the northern Black Range near Winston in Sierra County.

The above is only a partial indication of the types of fossils that have been found in geologic units that crop out in Sierra or Otero Counties. Many areas have been unexplored and unsurveyed for paleontological resources.

3.16 RECREATION

There is a wide variety of recreation opportunities in the Planning Area including several State parks, White Sands National Monument, and National Forest system lands. State Parks in the Planning Area include Elephant Butte, Percha Dam, Caballo Lake, and Oliver Lee. The BLM also manages portions

of the Tularosa River in Otero County for recreation. Four scenic byways are located within the Planning Area—Geronimo Trail, El Camino Real, Lake Valley Byway in Sierra County, and Sunspot Highway in Otero County. Recreation resources are depicted on Map 3-10.

There are many diverse opportunities for recreation, both dispersed and developed. Dispersed uses include hiking, camping, rockhounding, birdwatching, hunting, and ORV use over large areas encompassing most of the land in the Planning Area, independent of developed facilities. Typically these uses occur near the major population centers of Truth or Consequences and Alamogordo or in the various mountain ranges located in the Planning Area.

3.16.1 Recreation Sites

The only developed BLM recreation site in the Planning Area is the Three Rivers Petroglyph Site and Picnic Area in Otero County. The site contains more than 21,000 petroglyphs as well as a partially excavated and restored prehistoric village. Facilities include two self-guided interpretive trails, handicap-accessible bathrooms, picnic shelters, and a group shelter. The petroglyph trail is partially handicap accessible and includes a spotting scope for individuals unable to go farther along the trail to view the petroglyphs up close. Visitation varies between 25,000 to 28,000 visitors annually. Volunteer camp hosts reside on site. The entire area is now within the Three Rivers ACEC.

Although not a developed recreation site, the historic townsite of Lake Valley in Sierra County is becoming a tourist destination. It is located along the Highway 27 portion of the Lake Valley Backcountry Byway. Volunteer caretakers have resided on site since November 1, 1994. Facilities include a public restroom, water, and a self-guided interpretive trail. The Schoolhouse, which contains much of the original artifacts and furniture, has been restored and is open for visitation daily. Numbers of entries in the Schoolhouse visitor registry were 1,430 between November 1, 1994 and December 16, 1995; 1,936 in 1996; and 1,816 in 1997.

3.16.2 Off-Road Vehicle Use

ORV use occurs throughout the area and can be characterized as either a method of transportation or as a direct recreation use. As a transportation category, ORVs are used to transport recreationists, such as hunters, to recreation sites. A small amount of this use occurs in the Planning Area. The second category, as a recreation use, includes motorcycle races and hill climbing. This type of use occurs near the population centers of Truth or Consequences and Alamogordo. Considerable ORV use occurs in the area know as Red Sands. This is approximately a 10-mile by 10-mile area on the west side of Highway 54, midway between Alamogordo and Orogrande. An annual enduro race, the

Tarantula 100, normally draws between 150 and 200 contestants from several states. The staging area is the blow-sand-depleted section of Community Pit No. 7. The area receives an increasing amount of weekend use.

ORV use is subject to three levels of designations on public land—areas open to ORV use, areas limited to existing roads and trails, and areas closed to all ORV use. The majority of the Decision Area is open to ORV use. Areas classified as closed or limited to using existing or designated roads are described in Continuing Management Guidance in Chapter 2.

3.17 VISUAL RESOURCES

The Planning Area is located within the Colorado Plateau physiographic province (Fenneman 1931) generally in the south-central portion of New Mexico, in Otero County to the east and Sierra County to the west. This province is subdivided further into province sections including the Datil (Sierra County), Mexican Highland (Sierra and Otero Counties), and Sacramento (Otero County) sections (Forest Service 1989). The Planning Area is generally bounded on the southeast by the Guadalupe Mountains, on the west by the Black Range Mountains, and on the north by the Jornada del Muerto Wilderness Study Area (WSA). The Sacramento and San Andres Mountains occur within the central portion of the Planning Area. A more detailed description of the province sections that are within the Planning Area is provided in the MSA.

3.17.1 Landscape Character

Within the Planning Area seven landscape character types were identified—volcanic formations, escarpments, foothills, mesas, riparian areas, alkali flats, and developed areas. These landscape character types were identified through analysis of major landform characteristics, and all occur within the sections mentioned above, Datil, Mexican Highland, and Sacramento. Landscape characteristics within the Planning Area are described in the MSA.

3.17.2 Scenic Quality

Scenic Quality Class A areas are associated with escarpments, volcanic formations, and riparian areas. Areas considered to be of Class A scenic quality within the Planning Area include the Sacramento Escarpment, intrusive formations of the Cornudas Mountains, and riparian areas identified in the Tularosa watershed, Three Rivers, and along the Rio Grande.

Scenic Quality Class B areas are associated with foothills and open mesas. Within the Planning Area foothill areas along major travel routes and Otero Mesa were rated Class B.

Scenic Quality Class C areas are associated with alkali flats and developed areas. Within the Planning Area major population centers were rated Class C.

3.17.3 Sensitive Viewpoints

Highly sensitive viewpoints within the Planning Area were inventoried as a component of either residential communities; parks, recreation areas, ACECs, and WSAs; travel routes; and significant cultural sites.

3.17.4 Distance Zones

Distance zones are established based on perception thresholds. Perception of form, line, color, and texture changes as distance from a viewpoint becomes greater. Landscape elements tend to become less obvious and detailed at greater viewing distances. The elements of form and line become more dominant than color or texture at longer viewing distances. The BLM's Visual Resource Management (VRM) system utilized the following distance zones to evaluate the potential visibility when matrixed with contrast:

- Foreground - the limit of a viewed area in which details are perceived and obvious. Textural and other aesthetic qualities are normally perceived within this zone (0-0.25 mile [0-400 meters] to 0.5 mile [400-800 meters]).

- Middleground - the zone in which details of foliage and fine textures cease to be perceptible. Vegetative patterns begin to appear as outlines or patterns (0.25-0.5 mile [400-800 meters] to 3-5 miles).

- Background - those portions of the landscape where texture and color are weak and the landforms become the most dominant elements (3-5 to 15 miles).

3.17.5 VRM Classes in Context of BLM's Decision Area

The inventory of visual resources in BLM's Decision Area and the development of VRM classes were completed for Sierra County in 1977 and for Otero County in 1980. Each VRM class was determined through a matrix, which combines scenic quality, visual sensitivity, and distance zones. BLM VRM Classes in the Planning Area are shown on Map 3-9.

There are five ACECs that have visual and scenic value. The Sacramento Escarpment ACEC was established for the purposes of protecting and enhancing visual resources. The Escarpment offers

outstanding opportunities for visitor solitude, opportunities for a primitive type of recreation, and the presence of historical and biological amenities add supplemental values. The other ACECs with visual values are Three Rivers Petroglyph Site, Cornudas Mountain, Wind Mountain, and Alamo Mountain.

Within BLM's Decision Area all scenic ACECs are within a VRM Class I designation and include portions of the Sacramento Escarpment ACEC, Cornudas Mountain ACEC, Wind Mountain ACEC, and Alamo Mountain ACEC (BLM 1997b). These ACECs are closed to leasing.

Within the Decision Area the two WSAs are within a VRM Class II designation and include the Jornada del Muerto and Brokeoff Mountains WSAs. Additionally, areas along I-25 and the Rio Grande (T. 13 S. to T. 18 S.), areas within the Tularosa watershed, Nutt Mountain (Sierra County), along the Sacramento Escarpment, in the area of Bent, and along SR 70 are within a VRM Class II designation.

Within the Decision Area the majority of land that occurs along interstates and State highways is within a VRM Class III designation. The Three Rivers ACEC is a VRM Class III designation.

Within the Decision Area the majority of seldom seen areas along travel routes is within a VRM Class IV designation. Also, Alkali Lakes ACEC is within a VRM Class IV designation.

3.18 SPECIAL MANAGEMENT AREAS

The Decision Area contains several BLM special management areas including WSAs, ACECs, and McGregor Range. Since all of these areas have been closed to fluid minerals leasing and development previously (refer to continuing Management Guidance in Chapter 2 for the authority under which each is closed), only brief descriptions are provided below. Also, there are eight areas that have been nominated to become ACECs. All of the special management areas are shown on Map 3-10.

3.18.1 Wilderness Study Areas

The two WSAs located in BLM's Decision Area are Brokeoff Mountains and Jornada del Muerto. BLM manages a third WSA in the Planning Area, Culp Canyon, located within the boundaries of McGregor Range, which is not included in the analysis for this RMPA/EIS. The WSAs are characterized by a high degree of apparent naturalness and landscape diversity. All three are classified as VRM Class II and provide opportunities for hunting, primitive recreation activities, and solitude.

Whether or not the wilderness designation is recommended as suitable by the BLM, all WSAs are under interim wilderness management to protect their wilderness qualities. Congress must act on BLM recommendations to either release the areas from further wilderness consideration or to formally designate them as wilderness.

3.18.2 Areas of Critical Environmental Concern

ACECs are designated by the BLM to recognize, protect, and manage unique or sensitive resources. There are six ACECs in BLM's Decision Area (and one within the boundaries of McGregor Range—McGregor Black Grama Grassland ACEC). These are all located within Otero County, and include Three Rivers Petroglyph Site, Sacramento Escarpment, Cornudas Mountain, Alamo Mountain, Wind Mountain, and Alkali Lakes ACECs. These areas tend to be characterized by the presence of cultural resource sites and/or opportunities for primitive recreation and wildlife observation.

3.18.3 Nominated ACECs

Eight areas in BLM's Decision Area have been nominated to become ACECs (Dunmire 1992, BLM 1999b). These nominations are based primarily on the presence of special status species. The nominated ACECs are listed below and shown on Map 3-8.

- Brokeoff Mountains Nominated ACEC has a full range of habitats occurring. Species include Guadalupe needlegrass (*Stipa curvifolia*), gray sibara (*Sibara grisea*), cliff nama (*Nama xylopodum*), and five-flower rockdaisy (*Perityle quiniqueflora*).

- Caballo Mountains Nominated ACEC is a desert bighorn reintroduction habitat.

- Jarilla Mountains Nominated ACEC has a high-diversity cactus community (possibly the highest known diversity of cactus species in New Mexico). Also, there is a unique hybrid swarm of *Echinocereus X roetteri var. Roetteri*, a past (delisted) Federally listed endangered species.

- Mud Mountain Nominated ACEC has plants and habitat of Duncan's pincushion cactus (*Coryphantha duncanii*), a BLM-sensitive and U.S. Fish and Wildlife Service species of concern; the high plant diversity; and the specialized limestone plant communities in late seral status.

- Percha Creek Nominated ACEC has riparian habitat and a small igneous outcrop containing *Agastache cana* (a rare plant).

- Sacramento Mountains Nominated ACEC is to protect habitat and plants of *Hedeoma todsenii*, a Federally listed endangered plant, and associated plants spoonleaf rabbitbush *(Chrysothamnus spathulatus)* and threadleaf horsebusch *(Tetradymia filifolia)*, and also common button cactus *(Epithelantha micromeris)* and desert rose *(Rosa stellata).*

- Six Shooter Canyon Nominated ACEC is to protect habitat for Guadalupe mescalbean *(Sophora gypsophilia* var. *guadalupensis)*. In addition, five flower rock-daisy *(Perityle quiniqueflora)* and Guadalupe needlegrass *(Stipa curviflora)* occur within the area.

- Pup Canyon Nominated ACEC includes two endemic species—the gypsum ringstem (*Anulocaulis leisolensus* var. *howardii*) and gypsum blazing star (*Mentzelia humilis* var. *Guadalupensis*)—as well as habitat for several endangered/sensitive species and a diverse cactus community.

3.18.4 McGregor Range

McGregor Range encompasses approximately 606,198 acres within Otero County that are owned by the Federal government and jointly managed by the U.S. Army and BLM. The majority of the acreage is public land that has been withdrawn from public use, and the remainder is Army acquired (fee-owned) lands or Forest Service land. McGregor Range is part of the Fort Bliss Training Complex and provides for military use, grazing, wildlife and habitat management, and recreation. McGregor Range is not included as part of this RMPA/EIS analysis. It is addressed in the McGregor Range RMPA (BLM 1990a) and the decisions documented in that RMPA will be carried forward.

3.19 SOCIAL AND ECONOMIC CONDITIONS

Otero and Sierra Counties are rural counties with per capita and household incomes that generally are lower than the State average. Public infrastructure and services are clustered in population centers such as Truth or Consequences and Alamogordo. The military is very significant to Otero County's economy, and retail and other services are important in both counties. Agriculture is not as important a job- or earnings-provider in either county. Tourism also is a factor in Sierra County, which contains several State parks.

3.19.1 Demographics

Selected demographic information is illustrated in Table 3-9. The population of Sierra County is older than that of Otero County and the State as a whole. Table 3-10 indicates that population projections suggest positive but slowing growth over the next 30 years.

TABLE 3-9
SELECTED DEMOGRAPHIC INFORMATION

	Sierra County	Otero County	New Mexico
Population	11,052	56,945	1,729,751
Race			
White	72.8%	60.4%	48.6%
Black	0.6%	5.8%	1.9%
American Indian, Eskimo, or Aleut	0.8%	6.0%	8.5%
Asian and Pacific Islander	0.2%	2.6%	1.1%
Hispanic	25.1%	23.1%	38.3%
Income			
Per capita income	$16,956	$15,479	$18,814
Median household income	$17,020	$26,258	$26,802
Percent of people of all ages in poverty	23.3%	17.4%	20.2%

SOURCES:
For demographic information: Regional Economic Information System 1997
For per capita income: Regional Economic Information System 1996
For median household income: U.S. Bureau of the Census 1993
For poverty information: U.S. Bureau of the Census 1995
NOTE: There may be some double counting of the Hispanic population within the percentages of races other than White.

TABLE 3-10
POPULATION PROJECTIONS

Year	Sierra County		Otero County		New Mexico	
	Population	Percent Change	Population	Percent Change	Population	Percent Change
1990	9,994	-	52,028	-	1,519,889	10.9
1995	10,685	7.5	55,027	5.8	1,686,299	8.0
2000	11,338	6.1	57,537	4.6	1,821,078	7.4
2005	11,926	5.2	59,472	3.4	1,956,725	6.8
2010	12,502	4.8	61,057	2.7	2,090,678	6.8
2015	12,972	3.8	62,700	2.7	2,232,424	6.8
2020	13,380	3.1	64,277	2.5	2,380,802	6.6
2025	13,729	2.6	65,481	1.9	2,534,964	6.5
2030	14,046	2.3	66,238	1.2	2,691,578	6.2

SOURCE: Bureau of Business and Economic Research 1997

Both counties contain a majority of White residents, although the Hispanic population totals approximately a quarter of total residents. In comparison with New Mexico as a whole, Sierra and Otero Counties have disproportionately large White populations and smaller proportions of Hispanic populations. Sierra County has a small percentage of Black and American Indian, Eskimo, or Aleut residents compared to the State, whereas Otero County has a much larger percentage of Black residents than the average throughout the State.

Per capita income in both counties is lower than State median; Sierra County has a substantially lower household income than either Otero County or the State. When compared to the entire State, a greater

percentage of Sierra County residents live in poverty while a smaller percentage of the more populous Otero County live in poverty.

The 1990 Census indicated that the population of rural portions of Otero County totaled 15,826 or 30.5 percent. In Sierra County, the rural population was 3,731 or 37.6 percent. The majority of each county's population is clustered within Alamogordo or Truth or Consequences.

The Mescalero Apache Indian Reservation is located within Otero County. The tribal population is 3,619. There are 868 households on the reservation and an average household size of 4.17. The median family income is $16,536 and unemployment has reached 43 percent, much higher than the county or State unemployment rate (Mescalero Apache Indian Tribal Office 1993).

With regard to environmental justice concerns, demographic information for population centers in each county suggests that many of the larger communities reflect racial and income characteristics of the counties as a whole. A notable exception, however, is the Mescalero Apache Indian Reservation including the towns of Mescalero and Tularosa. These areas constitute disproportionate percentages of minorities (American Indian and Hispanic), lower median incomes, and a higher percentage of the population with incomes below the poverty level.

3.19.2 Housing

Table 3-11 illustrates housing characteristics for both counties. Both counties have experienced an increase in housing units since 1980, although Otero's stock is growing at a rate faster than both Sierra County and the State as a whole. Home ownership rates within the counties are similar to the State rate. However, rental vacancy rates are notably higher than the State average and homeowner vacancy rates are slightly higher in Sierra County. The median value of both owner-occupied and rental units is notably lower in the counties compared to the State average.

TABLE 3-11
HOUSING CHARACTERISTICS

	Sierra County	Otero County	New Mexico
Housing Units			
1980	5,392	17,961	507,513
1990	6,457	23,177	632,058
Percent change 1980-1990	19.8%	29.0%	24.5%
Urban and Rural			
Urban			
Inside urbanized area	0	0	268,612
Outside urbanized area	3,618	14,546	185,952
Rural			
Farm	129	156	5,328
Nonfarm	2,710	8,475	172,166
Age of housing			
Median year structure built	1972	1971	1972
Occupancy/Vacancy			
Home ownership rate	73.3%	62.3%	67.4%
Percent occupied units with over 1 person per room	4.3%	5.5%	7.9%
Homeowner vacancy rate	5.6%	3.0%	2.3%
Rental vacancy rate	21.8%	16.1%	11.4%
Financial Characteristics			
Median value of owner-occupied units	$49,500	$58,000	$70,100
Median value of renter-occupied units	$186	$291	$312

SOURCE: U.S. Bureau of the Census 1990

3.19.3 Economic Activity

Sierra County

Mining activities were important in Sierra County at the turn of the century, after which government, tourism, and agriculture increased in relative importance to the economy. Table 3-12 indicates that retail, health services, construction, and agriculture continue to be important job providers. The largest employers in Sierra County are local, State, and Federal governments.

TABLE 3-12
EMPLOYMENT CHARACTERISTICS

	Sierra County		Otero County		New Mexico	
	Number of Persons Employed	Percent of Total Labor Force	Number of Persons Employed	Percent of Total Labor Force	Number of Persons Employed	Percent of Total Labor Force
Agriculture, forestry, and fisheries	270	8.3	607	2.5	20,485	2.9
Mining	57	1.7	29	0.1	15,559	2.2
Construction	336	10.3	1,473	60.0	46,703	6.6
Manufacturing, nondurable goods	27	0.8	170	0.7	18,111	2.6
Manufacturing, durable goods	88	2.7	1,175	4.8	35,053	5.0
Transportation	108	3.3	821	3.4	23,019	3.3
Communications and other public utilities	70	2.1	613	2.5	18,018	2.5
Wholesale trade	51	1.6	385	1.6	20,902	3.0
Retail trade	640	19.6	3,419	14.0	116,210	16.4
Finance, insurance, and real estate	208	6.4	779	3.2	33,651	4.8
Business and repair services	97	3.0	681	2.8	29,445	4.2
Personal services	134	4.1	1,047	4.3	23,238	3.3
Entertainment and recreation services	54	1.7	276	1.1	9,155	1.3
Public administration	246	7.5	2,368	9.7	49,242	7.0
Professional and Related Services						
Health	337	10.3	1,008	4.1	47,039	6.6
Educational services	193	5.9	1,710	7.0	64,577	9.1
Other professional and related services	101	3.1	1,343	5.5	58,865	8.3
In Armed Forces	7	0.2	4,453	18.2	14,874	2.1
Unemployment	235	7.2	2,097	8.6	54,888	7.8

SOURCE: U.S. Bureau of the Census 1990

Nearby tourist destinations include Elephant Butte Lake, Caballo Lake, and Percha Dam State parks. In addition, the historic El Camino Real crosses Sierra County, a trade and travel route first used by Coronado in 1581. The White Sands Missile Range covers the eastern half of Sierra County.

Otero County

Historically, Otero County served as a source of timber resources. The railroad system and Alamogordo Lumber Company were established in Alamogordo, and were important to the establishment of a timber-based industry at the turn of the century (BLM 1986a). Since the late 1940s, the military has played a large role in Otero County's economy. Holloman Air Force Base develops

research and testing programs, and is by far the largest employer within the County. The presence of military personnel and civilian employees also has permitted the development of healthy retail and service sectors within Otero County's economy. Table 3-14 indicates the importance of the military and retail as job providers within the County.

Economic Activity on Public Land

Table 3-13 provides a recent example of the primary economic activities and revenue generated on public land within Sierra and Otero Counties. Grazing provides the greatest amount of revenue. Some mining has occurred, and sand and gravel have been the most lucrative mining activities to date. The potential exists for copper mining concerns; however, due to low copper prices, mining projects have not been operational. The revenue generated from fluid mineral leasing in Fiscal Year 1997 occurred entirely within Otero County, and represents a very small percentage (0.5 percent) of the total mineral revenue dispersed to the State of New Mexico.

TABLE 3-13
ECONOMIC ACTIVITY ON PUBLIC LAND

Economic Activity	Revenue, FY 1997
Minerals	
Sand and Gravel	$19,687.56
Fluid Minerals Leases	$93,188.60 dispersed to State (half of royalty value) (MMS 1997)
Copper	None
Grazing Leases	$794,176.19 (649,915 AUM) McGregor Contracts: $244,014.10
Wildlife (hunting-related expenditures)	Guides and Outfitters: $6,664.60
Recreation	$14,561.63
Right-of-way Issuance	$69,207.62
Land Disposal	0

SOURCES: U.S. Department of the Interior, Mineral Management Services 1997; T. Hanley, personal communication, 1999

Hunting and other recreational activities including ORV use, camping, and sightseeing also occur on public land. Expenditures on retail and services within the local community constitute the primary economic impact of these activities.

3.19.4 Fiscal

Sierra County

Reflecting its smaller population and economy, the County's government has a much smaller budget than its neighbor Otero County, with $3.91 million in revenues and $4.16 million in expenditures. Local taxes are the primary source of revenues, while general government and public safety account for the majority of expenditures.

The County is permitted by the State Property Tax Code to levy taxes up to $8.85 per $1,000 of assessed valuation for general governmental services other than the payment of principal and interest on long-term debt and in unlimited amounts for the payment of principal and interest on long-term debt.

Otero County

In Fiscal Year 1997-1998, total revenues amounted to $13.34 million while expenditures totaled $16.95 million. For property taxes in Fiscal Year 1997, the County billed 7.772 per $1,000 of net assessed valuation of residential property and 11.320 per $1,000 of net assessed valuation for nonresidential property. Intergovernmental transfers provided the largest share of County government revenues ($5.90 million, or 44 percent) followed by various local taxes ($4.19 million, or 31 percent). The principal cost centers for the County are law enforcement and general government, accounting for three-fifths of total expenses.

3.19.5 Values, Beliefs, and Attitudes

People's values, beliefs, and attitudes were expressed through the scoping process for the RMPA/EIS. The oil and gas industry emphasized the importance of the potential economic benefits to local communities. Some local residents agreed with this position and view fluid minerals leasing and subsequent activities as a potential job provider. Others questioned how close drilling would occur to homes, and expressed concern over potential noise and visual impacts that may lower property values. The Otero Comprehensive Plan also cites public opposition to growth as a possible constraint to economic development.

Ranchers who attended scoping meetings were concerned about potential impacts on grazing leases and groundwater. Environmental groups have raised the issues of potential adverse impacts on nonrenewable resources and habitat.

Previous documents have identified diverse groups within the two counties (BLM 1986a). Recreational users generally agree that public land should be available for a diverse set of uses including hunting, conservation, and ORV use that require access and sometimes solitude. Ranchers may feel that ranching and farming represent a significant sector (custom and culture) of the human environment and also, as pre-existing uses, should have priority on public land.